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THE

SCIENCE AND ART

OF

OBSTETRICS.

BY

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TO

THE CLASS 1894–95 JEFFERSON MEDICAL COLLEGE.

YOUNG GENTLEMEN:

In dedicating to you the third edition of my work upon Obstetrics I testify the strength and happiness your industry, fidelity, and loyalty have given me.

Let me add to this note a quotation from one of the ablest and most eminent of my predecessors, one of the greatest of American medical teachers, the late Dr. Charles D. Meigs, asking you to make his prayer the rule of your lives: "I pray you ever to look upon the medical profession not as a business, but as a great Morality—not as a trade, but as a Mission appointed by God for the benefit of the children of men."

PREFACE.

In preparing the third edition of this work I have made some changes in the order in which the subjects are discussed, taking that adopted by me in oral instruction. Nearly one-third of the book has been rewritten, additional illustrations have been introduced, and my endeavor has been to make it a faithful reflex of obstetric science and art at the present hour.

"The judicious Hooker" said of his age that it "was full of tongue, and weak of brain." The present age might be described as full of tongue, so far as the publication of many volumes in the various departments of Medicine is concerned, but by no means weak of brain, as is evidenced by the many excellent works on obstetrics of comparatively recent issue. The favorable reception of the previous editions of this treatise, both by the profession in this country and in Great Britain, has been a source of sincere gratification, and I trust this third issue may be found to merit continued favor. The author is also grateful for the many honors he has received from the profession—honors that were often unexpected, never solicited, and, therefore, more highly appreciated.

The Contents and Index have been prepared by my assistant, Dr. Charles H. Reckefus.

THEOPHILUS PARVIN.

Philadelphia, July 20, 1895.

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ERRATA.

Page 17, foot-note, "mede-gemoct" should be "mede-genoot."

Page 44, "Vernier" should be "Varnier."

Page 52, second line from foot, "organ" should be "organs."

Pages 329 and 330, read "Farabeuf" instead of "Faraboeuf."

Page 349, twelfth line from foot, put "must" for "much."

Page 361, ninth line from top, "115" instead of "108."

Page 405, "Borak" should be "Porak."

Page 449, "Oregon" should be "Washington."

Page 657, omit "general" in second line from foot.

THE SCIENCE AND THE ART

OF

OBSTETRICS.

INTRODUCTION.

OBSTETRICS, the name given to one of the three fundamental divisions of medicine, is derived from the two words *ob* and *stare*, "to stand before," and strictly defined means the care of women during childbirth; but general use has extended the meaning of the term, so that it includes also the care of women in pregnancy, and in the puerperal state, or puerperality.

The words midwifery, tocology, parturition, and accouchement have been and still are more or less used as synonyms for obstetrics. The first term etymologically means, and for some centuries practically meant, attendance by women upon women in labor. The name midwife,[1] variously spelled, is first met with in the fourteenth century, while the coarse, contradictory compounds, man-midwife and man-midwifery, do not appear until some two or three hundred years later. *Accoucher*—from *ac* and *coucher*, a derivation that brings to mind the expression "put to bed," once not unfrequently used for attendance upon a case of labor—is the origin of the noun accouchement; but although the last term has been adopted from the French into the English language, it has not by general use acquired full right of domicile. Tocology is a word rarely used by the profession; and parturition, from the Latin *partus*, has been by some authors restricted to the phenomena of labor occurring in inferior animals. It has seemed to me that *maieutics* is a better term, were it generally adopted, than any of

[1] I am indebted to Professor March, of Lafayette College, Easton, Penn., for the following note: *Midwif* does not appear in the Anglo-Saxon so far as yet explored; but in the earliest Old English vocabulary, the Promptorium Parvulorum, is *mydwife*, obstetrix (A. D. 1440). It is found earlier, in Piers Plowman, A. D. 1394; Myrc's Duties of a Parish Priest, A. D. 1400, spelt *mydwyf* and *midwif*. In Wycliffe's Bible, A. D. 1380, it is *medewife*, and in the later version of that Bible *mydwif;* William de Shoreham's Poems, A. D. 1330, *medewif*. This is the earliest appearance I know of.

I suppose it to be from *mid* and *wif*. The prefix *mid* is common. *Mid-coyshta*, a coworker, is found in Anglo-Saxon; in Dutch, *mede-broeder*, a companion; German, *mit-bruder;* D. *mede-gemoct*, G. *mit-helfer*, etc. The idea is that of the Spanish *co-madre*, co-mother, a midwife, and like the German *bei-frau*. It may be conjectured that as a doctor's word it was liable to fanciful learned spelling, and that the Latin *medius* led to its being spelt *medewif* occasionally, or that the Dutch form influenced it. At any rate, this bad spelling led to the theory that it was *mede-wife*, which has been favored by Trench and others. The theory working in the minds of the early writers may also have led to the spelling. It is, however, a comparatively rare spelling, and the derivation suggested by it improbable.

those mentioned. It is more euphonious than obstetrics, and is equally classic in origin—*μαιευο*, and *μαιευτής* a male obstetrician, and *μαιευτήρ* a female obstetrician—and does not prejudice the sex of the attendant, as the word midwifery does. But the substitution of obstetrics by maieutics would be regarded as too great an innovation, and hence the former will be used in this treatise.

Obstetric science means the classified knowledge of the laws of human reproduction; obstetric art includes the rules drawn from those laws, or from intelligent experience, which are to be observed in individual cases of women in pregnancy, in labor, or in childbed. While obstetric art may claim an antiquity as great as either of the other departments of medicine, obstetric science is of recent origin.

The tardy development of obstetric science is to be chiefly attributed to the fact that childbirth being regarded, justly, as a physiological function, and pathological conditions comparatively seldom occurring in its course, the practice of the obstetric art was almost exclusively in the hands of ignorant matrons; educated physicians were, if consulted at all, only called in case of serious difficulty. In the time of Hippocrates dividing the umbilical cord seems to have been considered the chief duty of the midwife; she was called the omphalotomist. There could be but little progress with so narrow a conception of the office and with the scant qualifications of those assuming it. It is true that at one time in the history of Athens, if the story concerning Agnodice be accepted, men only were permitted to practise obstetrics; but this custom was altogether exceptional, and even in the most enlightened nations the rule, until comparatively recent years, was that women in labor were under the care of one of their own sex. So universal was the custom of employing midwives, and so strong the prejudice against men engaging in obstetric practice, that in 1522 Dr. Wertt, of Hamburg, who, having put on the dress of a woman, and thus disguised attended a case of labor, was burned alive for the offence; and, a little more than a century later, Dr. Percivall Willughby, an eminent English physician, assisted his daughter, who was a midwife, in a case of difficult labor, crawling into the darkened room of the parturient on his hands and knees without her knowledge.

Chereau remarks that obstetrics was at first empirical, then superstitious, then scholastic, that is to say, the almost absolute slave of theories and discussions, and that it did not attain finally a scientific character until the sixteenth and seventeenth centuries.

The obstetrician has a graver responsibility than has either the medical or surgical practitioner, for he has charge of two lives instead of one; while his efforts are directed to saving both, yet in some instances it may be that the one must be sacrificed for the salvation of the other, or saved at great risk to the other: hence may arise the most serious questions in casuistry.

The importance of obstetric knowledge is further shown by the fact that very frequently the emergencies which occur in the practice of the art are sudden, and must be met promptly if successfully. They may give no time for consulting books or a fellow-practitioner, but immediate as is the peril must be the means to avert it.

Further, should an unfavorable result occur, the public is apt to visit unjust reproach upon the obstetrician; it is slow to understand how that which is usually a physiological process may end in death or in lasting disability. The obstetrician thus not only rests under greater responsibility than the physician or the surgeon, but is also liable to severer censure in case of failure or misfortune.

This work is divided into two parts, the first relating chiefly to physiology, and the second to pathology. The former includes the physiology of pregnancy, of labor, and of the puerperal state, and the latter the pathology of each of these. In connection with the pathology of labor obstetric operations will be presented, and in that of the lying-in there will be embraced not only the diseases of the mother but also those of the newborn.

The anatomy of the pelvis and that of the female sexual organs, with their physiology, will precede and introduce the physiology of pregnancy.

PART I.

SECTION I.

THE PHYSIOLOGY OF PREGNANCY.

CHAPTER I.

ANATOMY OF THE PELVIS.

The pelvis is that part of the skeleton placed at the inferior portion of the body which receives the weight of the head and trunk and transmits it to the lower limbs. It has its name from a supposed resemblance in form to a basin once used by barbers, or from the fact that it serves as a temporary receptacle for certain secretions. Within or upon the pelvis the organs of reproduction are placed; through its canal the fœtus and its appendages pass; and the most serious difficulties in labor arise from its deformities. The study of the pelvis, therefore, is the first part of obstetrics; this knowledge is the very alphabet of obstetric science, and is the foundation of obstetric art.

The anatomical pelvis is formed by the union of four bones, viz., the two ossa innominata, the sacrum, and the coccyx; the obstetric pelvis includes also the last lumbar vertebra. But while the *static* pelvis is thus constituted, the *dynamic* pelvis—the pelvis in the living subject and in labor—has in addition certain structures which make its floor and prolong the birth-canal; it is necessary for the obstetrician[1] to know two pelves: the one osseous, fixed, passive; the other soft, mobile, active The former will be described first.

Pelvic Joints. Seven joints unite the bones forming the obstetric pelvis. They are three sacro-lumbar, two sacro-iliac, one sacro-coccygeal, and one pubic. Five of these joints are amphiarthroidal.

Sacro-vertebral Joints. The sacrum articulates with the last lower lumbar vertebra by the upper surface of the body of the first sacral vertebra and by the two facets of the articular apophyses of this vertebra. Corresponding surfaces are presented by the under surface of the last lumbar vertebra; the union is similar to that existing between the other vertebræ. A remarkable peculiarity of the articulation is that the inter-vertebral disk of fibro-cartilage is twice as thick in front as it is behind, and thus the sacro-vertebral angle is formed.[2] The pelvic inclination does not depend entirely upon the angle, but in part upon the obliquity of the innominate bones to the sacrum. The

[1] Boissard: De la forme de l'Excavation Pelvienne. Paris, 1884.
[2] Morris: Anatomy of the Joints.

union between the bodies of the vertebræ is amphiarthrodial, but that between the apophyses is arthrodial.

Sacro-iliac Joints. According to Sappey, these joints are intermediate between mobile and semi-mobile joints, though classed by most authorities as amphiarthrodial. Anatomists in general state that the auricular surface of the innominate bone and the corresponding surface of the sacrum are covered with cartilage, the covering being much thicker upon the latter than upon the former; that which is upon the innominate is fibro-cartilage; that of the sacrum consists, first, of cartilage adhering to the bone; and, second, of fibro-cartilage. The existence of a synovial membrane, especially distinct in case of pregnancy, is taught by some authors. Gray, for example,[1] states that in the early period of life, occasionally in the adult, and in the female during pregnancy, the intervening cartilages are in part smooth and lined by a delicate synovial membrane. Morris,[2] however, holds that the cartilaginous mass uniting these bones is single, and not composed of two plates with a synovial space between them, stating that such may be the case sometimes, but that it is not constant, certainly not in the male, though more frequent in the female; if two plates are present, the joint is arthrodial.[3] The joint is further secured by the following six ligaments: the ilio-lumbar, extending from the transverse process of the last lumbar vertebra to the crest of the ilium, is a firm band of fibrous tissue which not only greatly strengthens the joint, but helps to form the posterior wall of the false pelvis; the antero-superior, the antero-inferior, the postero-superior, the postero-inferior, and the interosseous ligament complete the direct means by which this joint is made one of the strongest in the body. But additional strength is given to it by the sacro-sciatic ligaments. The great sacro-sciatic ligament, known also as the tubero-sacral ligament, arising from the posterior part of the superior curved line of the dorsum of the ilium, from the postero-inferior ilio-sacral ligament, from the side of the sacrum and of the coccyx, is attached to the lower portion of the ischium and to its ramus; this ligament is broad at first and then in its middle is narrowed, but again widens as it approaches its points of attachment. The less sacro-sciatic ligament, or sacro-spinous ligament, is in front of the former, and is triangular in shape; it arises from the sides of the sacrum and the coccyx, and is at first confounded with the great ligament; afterward it becomes distinct from the former in making the lower boundary of the great sciatic foramen, and passes to its attachment to the spinous process of the ischium.

When in labor the head has descended into the pelvic cavity, the expulsive force drives it against the lower portion of the sacrum, and hence results a strain upon the sacro-iliac joints tending to throw the lower part of the sacrum backward; but nature guards against such dislocation by these strong fibrous bands which unite the sacrum and the ischium.

The Sacro-coccygeal Joint. This is composed of two articular surfaces, an interosseous fibro-cartilage, and four peripheral ligaments. The retrocession of the coccyx thus secured adds materially to the

[1] Anatomy. [2] Anatomy of the Joints.
[3] J. Veit, in Müller's Handbuch der Geburtshülfe, asserts the presence of a true synovial joint cavity.

antero-posterior diameter of the outlet. Sappey states that, prior to their consolidation, all the inter-coccygeal articulations are symphyses, and Lenoir that the backward movement referred to takes place between the first two bones of the coccyx, as between the first and the sacrum; exceptionally this motion is found to be between the second and the third, or between the third and fourth. Verneau[1] says that he has frequently found even in young subjects complete synostosis of the sacrum and the coccyx, and describes the two as a single bone.

The Pubic Joint. Fibro-cartilage similar to that of the intervertebral disks is firmly fastened to the articulating surface of each pubic bone. The fibro-cartilage is soft in the middle, firm externally; it is much thicker in front than it is behind—thicker, too, in females than it is in males; the presence of a synovial membrane is asserted by some, Allen, for example,[2] stating that in the adult male its size is not greater than that of a split pea, but that it is larger in the adult female, and in the parturient may involve the entire thickness of the joint. Morris, however, only describes a fissure running through more or less of the antero-posterior as well as the vertical depth of the cartilage; it partially divides the cartilage into two plates, with a minute viscid pulp or a little fluid in the interspace; it is found in males as well as in females, but not constantly in either sex. Depaul and other French authorities generally deny the presence of a synovial membrane in the pubic joint; this, too, is the teaching of most anatomists. Four ligaments add to the strength of the joint. These are the posterior, which is chiefly thickened periosteum; the anterior, thicker and stronger than the preceding, is formed by several layers of fibres crossing each other obliquely, some of them continued into the inferior ligament; the superior consists of layers of yellowish fibres attached to the pubic crest on either side, and at the middle closely united with the interosseous cartilage; and, finally, the inferior or subpubic ligament. The last, also called ligamentum arcuatum, three-eighths of an inch in its vertical measurement, is composed of closely joined fibres, and fills up the angle made by the pubic rami, forming an arch, the pubic arch, a part of as great obstetric importance in the outlet as the sacro-vertebral angle is in the inlet of the pelvis.

Movements of the Pelvic Joints. Of course, there are in the three sacro-vertebral articulations movements similar to those of the vertebral joints elsewhere. There is also, as has been before mentioned, an important movement in the sacro-coccygeal joint, or in one or more intercoccygeal joints, allowing retropulsion or pushing back of the coccyx, thus increasing the antero-posterior diameter of the pelvic outlet. But are there movements in the other pelvic joints by which pelvic diameters are notably increased? Dr. J. Matthews Duncan holds that in labor important movements occur in the sacro-iliac joints, movements which he describes as an elevation and a depression of the pubic joint; or, if the sacrum be regarded as the moving bone, it has a nutatory motion upon an imaginary transverse line passing through its second vertebra. Elevation of the pubic joint, or its equivalent forward movement of the superior part of the sacrum, lessens the antero-posterior

[1] Le Bassin dans les Sexes et dans les Races.

[2] Human Anatomy.

diameter of the inlet, but increases the corresponding diameter of the outlet. On the other hand, Mattei and Laborie assert an increase in the transverse diameter of the outlet by the wedge-like pressure of the fœtal head.[1] But the form of the articular surfaces of the sacrum and the innominate bones is such—elevations upon the one fitting into depressions on the other, and the reverse—that any movement between these bones, whether it be described as rotation of the innominates upon the sacrum, or a movement of the base of the sacrum forward, while the lower portion of the bone moves backward, seems improbable, or impossible, in ordinary conditions. Moreover, the fixed position of the sacrum is further secured by its shape and by the ligaments belonging to the sacro-iliac joint, and also by the sacro-sciatic ligaments and by the ilio-lumbar ligaments. "The shape of the sacrum and the mode in which it articulates with the ossa innominata render its position a secure and ordinarily an immovable one."[2] Nevertheless the swollen condition of these points, often so great in the last months of pregnancy, may permit in labor some separation, and thus the area of horizontal pelvic planes be slightly increased.

Uses of the Pelvic Joints. If movements in the pelvic articulations are not great, why is not this osseous girdle made of a single bone? The answer given by Depaul is that these joints have as their result the decomposition of forces, and thus prevent shocks and jars received by the lower limbs being transmitted directly to the vertebral column. Thus the uterus and the ovum as well as the prolongation of the spinal cord in the sacral canal are guarded from injury. These joints, especially the pubic,[3] are swelled during pregnancy, permitting a slight separation; but such swelling may not be chiefly for the increase of pelvic diameters, but a protection against injuries from falls or jars: they serve a purpose similar to that of the cushioned buffers of railway cars.

The Pelvis as a Whole. *Its external surface.* This is of no great obstetric importance; still a few points are worthy of attention. One feature of the pelvis is most striking—the great difference as to completeness between its anterior and its posterior portion. Behind, the bony wall is complete from the beginning of the last lumbar vertebra to the tip of the coccyx; while in front the girdle presents a wide gap from the anterior margin of the iliac bones, above the pubic joint; the girdle is completed at the joint, but below another gap is formed, its boundaries being the divergent ischio-pubic rami. The ischio-pubic foramen[4] is observed on either side; this foramen is closed by a membrane, and

[1] Dr. Driver, in a paper read before the Massachusetts Medical Society, June, 1887, from a study of nearly 300 cases in his practice, concluded that in a large percentage of women there was an increase of about one-third of an inch in the pelvic diameters from relaxation of the pelvic ligaments.

[2] Morris.

[3] Budin (Progrès Médical, 1875) examined more than eighty pregnant women to ascertain whether there were movements in the pubic joint. The method of examination was to introduce the index-finger into the vagina and apply the pulp of the finger directly against the inferior margin of the joint while the subject was standing, and then have her walk. At each step she took he found that the finger was pushed down by the descending pubic bone of one or of the other side; that bone descended which corresponded with the limb moved; the one corresponding with the limb that was fixed remained without change in position. His conclusions were, that in all pregnant women there was in the last months of pregnancy a certain mobility in the pubic joint; this mobility is greater as the pregnancy approaches its end; almost absent in primiparæ, it increases with the number of pregnancies. Even where there was very considerable mobility the subjects walked without difficulty.

[4] Verneau remarks, op. cit., that "foramen ovale" is incorrect, and "obturator" meaningless.

covering the membrane a muscle, known as the obturator externus. The posterior surface, formed chiefly by the sacrum and coccyx, is triangular, the base of the triangle being superior. In the median line the sacral crest, formed by the fusion of the spinous processes of the sacral vertebræ, is found; on either side of the iliac tuberosity, and intervening between these and the sacral crest, is a gutter, the two portions being occupied in the fresh subject by the sacro-lumbar muscles, while at the external side of each the posterior sacral foramina open. In general the rough, irregular surface of the pelvis posteriorly is in striking contrast with the corresponding internal surface.

Internal surface of the pelvis. Though the external surface of the pelvis is rough and irregular, and presents no lines for artificial division, the internal surface is smooth and symmetrical and is plainly divisible into two parts, an upper and a lower, the dividing-line being formed by the upper anterior margin of the sacrum and its alæ, and the innominate, or ilio-pectineal line; this is better and more briefly called the *linea terminalis*. The upper portion is known as the false, superior, or large pelvis; while the lower is the true, inferior, or small pelvis, or simply the pelvic cavity. The posterior wall of the upper, or false, pelvis is formed by the last lumbar vertebra and the ilio-lumbar ligaments; its lateral walls are the iliac bones; in front the wall is absent, but in the living subject the gap is closed by the lower portion of the elastic abdominal wall, which, readily yielding, furnishes space for the uterus enlarging in pregnancy.

The convergence of the bony walls of the false pelvis—a convergence which, if continued, would cause them to meet at a point corresponding with the fourth sacral vertebra—has suggested the comparison of this part to a funnel which serves to direct the fœtus into the pelvic cavity. The comparison is more striking when we remember that in the living subject the interval between the anterior margins of the iliac bones is closed by the lower part of the abdominal wall.

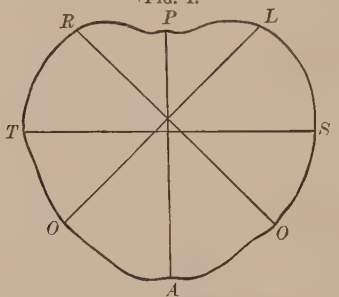
Measuring from the highest point of the iliac crests to the plane of the inlet, the distance is a little more than three inches and a half, or nine centimetres and a half. The distance between the anterior-superior spines is about ten inches, or twenty-six centimetres, and between the anterior-inferior spines a little more than nine inches, or twenty-four centimetres; the widest interval between the iliac crests is eleven inches, or twenty-eight centimetres. These measurements vary somewhat in different subjects, but any notable deviations from those given of the distances between the iliac crests, and between the spinous processes, would be indicative of pelvic deformity.

The Pelvic Inlet. The entrance to the pelvic cavity is called the inlet, superior strait, brim, margin, or isthmus. The fitness of the term inlet is plain, whilst, it being "narrower than the upper pelvis, less in extent than the lower," there is a fitness also in the names strait and isthmus. Pelvic deformities most frequently affect the inlet, and therefore its study has special importance. Its form is irregular, and has been compared to an ellipse, to a circle, to a spherical triangle, to the heart of a playing-card; it has also been described as oval and as kidney-shaped. Its regularity of form is chiefly broken by the pro-

jection of the sacro-vertebral angle, commonly called the promontory, and thus a large, round notch is made, which is similar to the notch in the playing-card heart.

The subjoined diagram represents the form of the inlet, and also the four diameters which are of obstetric importance. These diameters are one antero-posterior, one transverse, and two oblique. The oblique diameters connect what have been known as the four cardinal points of Capuron, viz., the right sacro-iliac symphysis with the left ilio-pectineal eminence, the left sacro-iliac symphysis with the right ilio-pectineal eminence. The first is known as the right,[1] the other as the left oblique diameter, the sacro-iliac symphysis determining the name.

FIG. 1.



THE INLET, OR SUPERIOR STRAIT.

A P. Antero-posterior diameter.	4.3 to 4.5 inches, or 11-11½ centimetres.	
T S Transverse.	5.3 " or 13½	"
R O. Right oblique.	4.7 to 4.9 " or 12-12½	"
L O. Left oblique.	" " " "	"

The circumference of the inlet is 15-8 inches, or 40 centimetres.

Further, it will be observed that the transverse diameter, which represents the widest measurement of the inlet, passes in front of the intersection of the oblique diameters, and this is characteristic[2] of the normal female pelvis, indeed one of the means by which the female can be distinguished from the male pelvis. The antero-posterior, sacro-pubic, or conjugate diameter extends from the sacro-vertebral angle to the pubic symphysis. The last is the shortest of the four, while the transverse is the longest; but the latter, as will be seen hereafter, is lessened by the encroachment of soft parts, so that each oblique diameter exceeds it, and hence the frequency of oblique positions of the fœtal head as it enters the inlet.

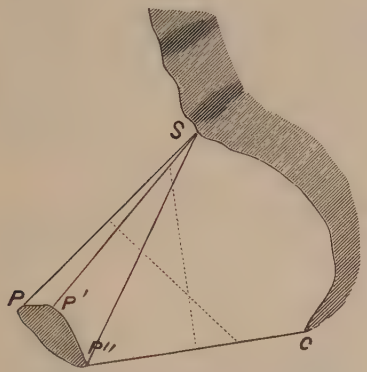
In addition to the antero-posterior diameter of the inlet which has been given, and which may be distinguished as the sacro-suprapubic, two other antero-posterior diameters are to be mentioned, called the sacro-subpubic and the minimum, useful, or true conjugate; the three diameters are represented in Fig. 2, from Pinard. It will be observed that all these diameters start from a common point at the sacro-vertebral

[1] Some confusion is caused by the fact that obstetric authors differ in the application of the terms right and left to these diameters, one designating that as right which another calls left, and *vice versa*. While the selection is chiefly arbitrary, it seems more natural that the relation of right and left be determined by the sacro-iliac joint concerned.

[2] This statement, made by Verneau, I have verified in the measurements of some twenty male and female pelves.

angle, but extend respectively to the superior margin of the pubic joint, to its inferior margin, and to its nearest point. In case of pelvic deformity involving the inlet, it is important to know what the minimum, useful, or true conjugate diameter is, and this is obtained by first ascertaining the sacro-subpubic diameter and deducting from it, if the pubic symphysis measures one inch and a half, four centimetres, or more, one-half to seven-tenths of an inch; but if the pubic symphysis is less than an inch and a half, the reduction must be one-half to three-tenths of an inch.

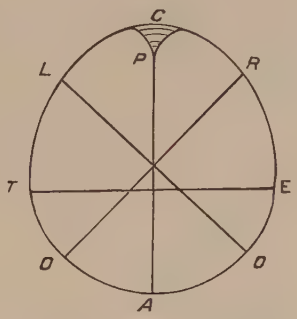
FIG. 2.



ANTERO-POSTERIOR DIAMETERS OF INLET.

S P. Sacro-suprapubic diameter.
S P'. Sacro-subpubic diameter.
S P''. Minimum diameter.

FIG. 3.



THE OUTLET AS SEEN FROM BELOW.

C. Under surface of the coccyx. *A P.* The antero posterior, or coccy-pubic diameter. *T E.* Transverse diameter. *R O* and *L O.* Right and left oblique diameters.

THE PELVIC OUTLET. While the boundaries of the inlet are formed of bone and present a comparatively regular outline, those of the outle are in part ligamentous and are marked by projections of bone, the ischial tuberosities and the coccyx, and deep intervals, the most important of which is the pubic arch. Nevertheless, a somewhat rhomboidal form is attributed to the outlet. The subpubic ligament is its anterior boundary, its posterior the coccyx, while intervening on either side are the ischio-pubic ramus, the ischial tuberosity, and the lower surface of the sacro-sciatic ligaments. The pubic arch is triangular, the base extending from one to the other ischial tuberosity, and its apex rounded by the subpubic ligament.

As in the inlet, so in the outlet, four diameters are given, one antero-posterior, or coccy-pubic, one transverse, and two oblique. The first measures the distance from the tip of the coccyx to the subpubic ligament; the transverse that between the ischial tuberosities; while the oblique extend on either side from the middle of the under surface of the sciatic ligaments to the junction of the ischio-pubic rami. The oblique diameters may be slightly increased by yielding of the sciatic ligaments, but this is unimportant. On the other hand, an important increase in the antero-posterior results from recession of the coccyx, so that it becomes the longest diameter of the outlet, whereas it is the shortest of the inlet; the latter, since it is the shortest diameter of an

ellipse, is correctly called the conjugate; but to apply this term to the former is plainly an error, or at least such application is purely arbitrary.

Each of these diameters is about 4.3 inches, or 11 centimetres. The antero-posterior is increased by the recession of the coccyx from one-half to one inch; the average increase is probably about three-fourths of an inch. The circumference of the outlet is 13.4 inches, or 34 centimetres.[1]

The Pelvic Cavity. The pelvic cavity, the small or true pelvis, thus bounded by inlet and outlet, is somewhat cylindrical or barrel-shaped. Its walls measure one inch and a half in front, three inches and a half at the sides, and posteriorly four inches and a quarter, or, following the curve of the sacrum, about five inches and a half; the corresponding metric measurements are: 3.8, 8.9, 10.8, and 13.8 centimetres. Mr. Morris[2] calls attention to an important fact in obstetrics, viz., that in no horizontal pelvic plane is the bony wall of the pelvis complete, for opposite the pubic symphysis is the movable coccyx, and thus at one point or at another of the cylinder there is always in some part of the plane either a joint motion or that permitted by elastic tissue. The protection from injurious pressure thus secured to the fœtus and the maternal soft parts is obvious.

Widest and Narrowest Part of Pelvic Cavity. The transverse measurements of the pelvic cavity lessen from above below, while the antero-posterior increase. The average diameters of the pelvic cavity are about four and three-quarters inches, or twelve centimetres. The antero-posterior diameter is measured from the middle of the posterior surface of the pubic joint to the middle of the line uniting the second and third sacral vertebræ; the transverse intersects and is perpendicular to the former; the ends of the diameter are in the vicinity of the acetabula; the oblique diameters connect the middle of each great sciatic foramen with the middle of the ischio-pubic foramen of the opposite side. The points which the oblique diameters connect not being fixed, little importance is attached to the latter. It is plain that any oblong body—and the fœtal head is such a body—which has greater length than four and three-quarters inches cannot, having entered the pelvic cavity, pass out of it unless that part first entering goes out first.

The narrowest part of the pelvis has for its transverse diameter the distance between the ischial spines, and for its antero-posterior that from the point of the sacrum to the lower border of the internal surface of the pubic symphysis; the former is 10.5 centimetres, or 4.14 inches, and the latter 11.5 centimetres, or 4.54 inches. The transverse diameter of the outlet, as before stated, is the distance between the ischial tuberosities—11 centimetres, or 4.34 inches.

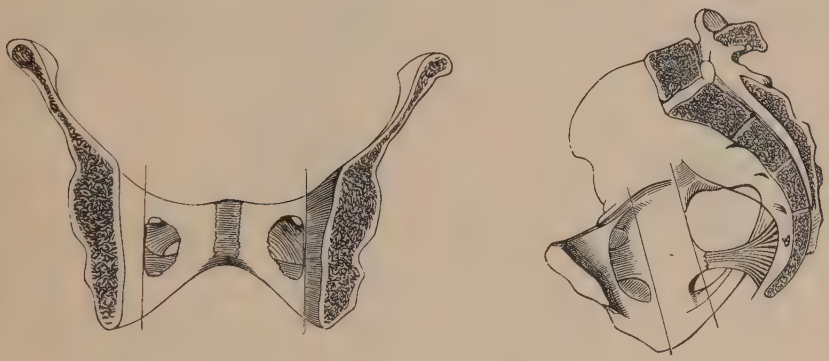
Inclined Planes of the Pelvis. The walls of the pelvic cavity, though presenting no natural lines of separation, have been arbitrarily divided so as to represent certain inclined planes which were held to have an important influence in determining a part of the mechanism of

[1] I have retained the above, with illustration, as given in the previous editions, though it will be obvious, when considering the narrowest part of the pelvis, that the head of the child after passing through that contracted portion will find no resistance from the mobile coccyx.

[2] Op. cit.

labor. These divisions have varied with different obstetric teachers. The late Dr. Hodge, for example, after the antero-posterior division of the pelvic cavity in the median line, had each half divided by a line beginning three-quarters of an inch in front of the sacro-iliac joint and extending downward to the extremity of the spine of the ischium ; thus two anterior and two posterior inclined planes were formed, and an object impinging upon either of the former rotated into the pubic arch, while if impinging upon either of the latter it rotated into the hollow of the sacrum. Other authors make the line of division between anterior and posterior planes further forward. Still others, after dividing the pelvic walls into anterior, posterior, and two lateral walls, divide each of the latter—a lateral wall includes the part of the pelvis between the sacro-coccygeal surface and a line drawn from the ilio-pectineal eminence downward through the ischial tuberosity—into two inclined planes, the anterior and the posterior. Figs. 4 and 5 show the anterior wall of the pelvic cavity and the lateral inclined planes.

FIG. 4. FIG. 5.



ANTERIOR PELVIC WALL AND LATERAL PLANES.

It ought, however, to be said that few obstetric authorities now attach to these arbitrarily formed planes the importance in explaining the mechanism of labor which was once given them.

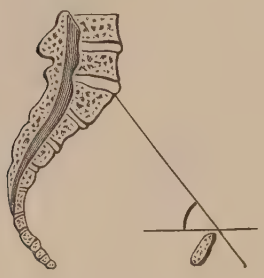
OBLIQUITY, HORIZONTAL PLANES, AND AXES OF THE PELVIS. The pelvis is not in the axis of the body, a fact which is at once evident when one observes that the sacro-vertebral angle is nearly four inches higher than the superior margin of the pubic joint, but it is placed obliquely with regard to that axis, and hence the expression *inclination* or *obliquity* of the pelvis. This obliquity is caused, first, by the form of the articulating face of the upper sacral vertebra, which is so oblique as to make an acute angle with the anterior surface of the body of the bone; second, by the shape of the cartilage between the sacrum and the lumbar vertebra with which it articulates; and finally by the obliquity of the innominate bones in their articulation with the sacrum. The result of this obliquity is that the weight of the gravid uterus is borne chiefly by the anterior abdominal wall and the superior border of the pubis. In order the better to show this obliquity of the

pelvis it may be stated that the angle made by the antero-posterior diameter of the inlet and a line representing the axis of the body is from 130° to 140°, and that this diameter prolonged in front makes with a horizontal line an angle of 60°.

While, as taught by Naegele, the obliquity of the pelvis was represented by the angle made by the antero-posterior diameter of the inlet with a horizontal line—the subject standing—an angle which varied from 55° to 60°, it is now held that this angle may vary greatly within even the lower of these limits, as the following passage from Kleinwächter[1] explains:

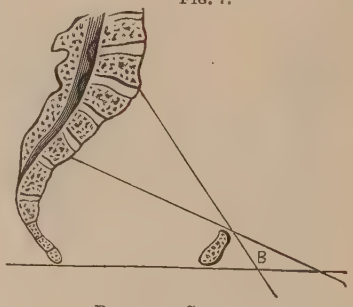
> Naegele understood by it that angle which the conjugata vera makes with the horizon. (Fig. 6.)
>
> Later researches showed, however, that, although this hypothesis is in general true, still the angle has no fixed size, but changes with various positions of the body. The most reliable angle (Fig. 7, *B*), indicating the pelvic obliquity, is, according to H. Mayer, that which a horizontal line makes with the so-called diagonal conjugate, the distance from the upper margin of the pubic joint to the middle of the anterior surface of the third sacral vertebra: this angle measures 30°. The pelvic inclination, too much overrated in former times by Stein the elder and Naegele the elder, does not have any practical significance, for it may be changed by a corresponding change in the position of the parturient.

FIG. 6.



PELVIC OBLIQUITY.

FIG. 7.



DIAGONAL CONJUGATE.

It will be seen (Fig. 8) that the coccy-pubic diameter prolonged in front makes an angle with the horizontal line of 11°, or 10° to 11°. But if the coccyx be pressed backward, as it is in labor, that diameter coincides with the horizontal line at first, and then forms an angle with, but below it.

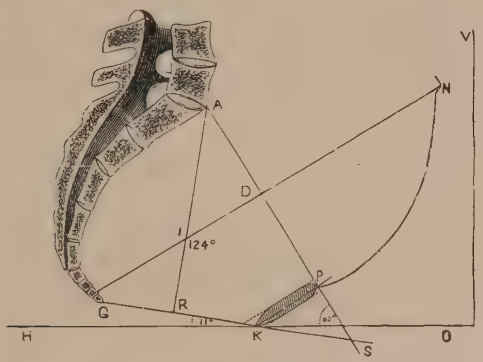
The plane of the inlet is a surface supposed to touch all points of the circumference of the inlet; the antero-posterior diameter of the inlet is a line which measures that surface from before backward. The axis of the inlet is a perpendicular to the surface at its middle point, or, more simply, a perpendicular to the antero-posterior diameter at its middle.

Similarly the plane of the outlet is a surface which theoretically touches all points in its circumference; the axis of the outlet is a perpendicular erected at the middle of its antero-posterior diameter. As will be seen from Fig. 8, the axis of the inlet prolonged below

[1] Grundriss der Geburtshülfe.

meets the axis of the outlet, forming with it a very obtuse angle. In the illustration this angle measures 124°. Further, as shown in the diagram, the two antero-posterior diameters mentioned, if prolonged in front of the pubic joint, soon meet; but as these lines simply represent the middle of the surface of the inlet and that of the outlet, it follows that the planes of the inlet and outlet would in like manner meet. If the axis of the inlet be continued beyond the point where it meets that of the outlet, it would strike the coccyx—according to some, the sacro-coccygeal articulation; extended above, it passes out at or a little below the umbilicus. It is, therefore, obvious that the plane of the inlet is very oblique, while that of the outlet—the subject supposed to be standing—is nearly horizontal. Behind, the planes are separated by the length of the anterior surface of the sacrum and coccyx, while in front only the length of the pubic joint intervenes. It follows that the

FIG. 8.



PLANES AND AXES OF THE INLET AND THE OUTLET.

H O. Horizontal line. *V O.* Vertical line. *N.* Umbilicus. *A R.* Axis of the outlet intersecting, at *I*, the axis of the inlet. *A P.* Sacro-pubic diameter. *G K.* Coccy-pubic diameter.

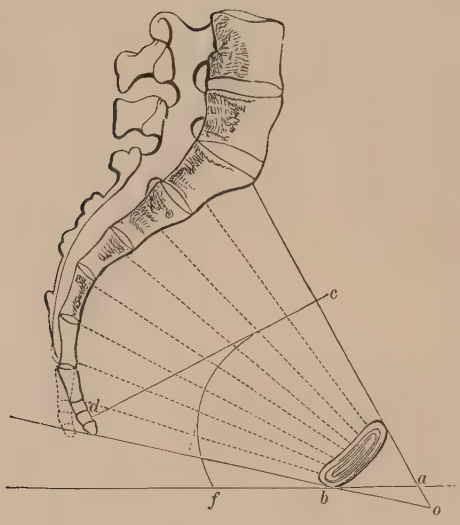
planes of the pelvic cavity cannot be parallel, but must converge as they move from the posterior wall, meeting in front of the pubic joint, and are included between the plane of the inlet and that of the outlet. To ascertain the mathematical axis of the pelvic cavity, a series of planes may be imagined to extend from the intersection of the inlet and outlet planes to the anterior surface of the sacrum and coccyx. Next find the central point of each of these planes in the pelvic cavity, and then a line connecting these points is drawn; this line, which is curved, its concavity anterior, represents the axis of the pelvis.

The pelvic axis is also called the central line and the line of direction. It may be defined as a curved line passing through the centre of the pelvic cavity, equidistant from the sacrum and the pubic bone. While on theoretical grounds it is claimed that the fœtus in its passage through the pelvic cavity follows this curved line, and that in the use of the forceps traction should be made according to this line, yet it is to be borne in mind that this view applies to the static pelvis only, and it will be materially modified by the study of the

dynamic pelvis. Fig. 10, from Leishman, illustrates the generally accepted statement as to the axis of the birth-canal, that is, of the pelvis and its prolongation by the addition of soft parts yet to be described.

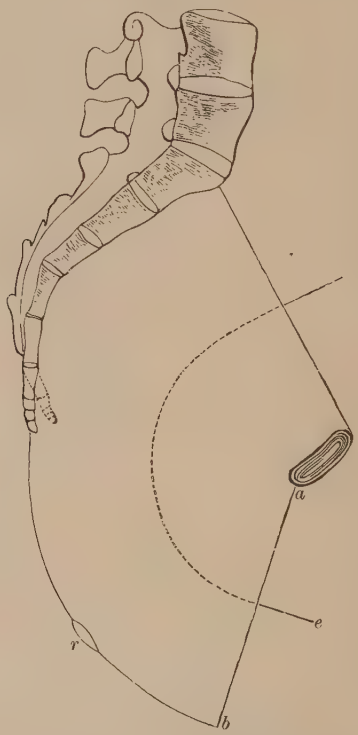
While the relation between the pelvic planes and the pelvic axes is necessarily unchangeable, always remaining the same whatever the position of the body, the relation of these planes and axes to the body and to the horizontal line is necessarily changed by that position. For example, let the subject be standing. The axis of the body makes with

FIG. 9.



INCLINATION AND AXIS OF THE PELVIS.

FIG. 10.[1]



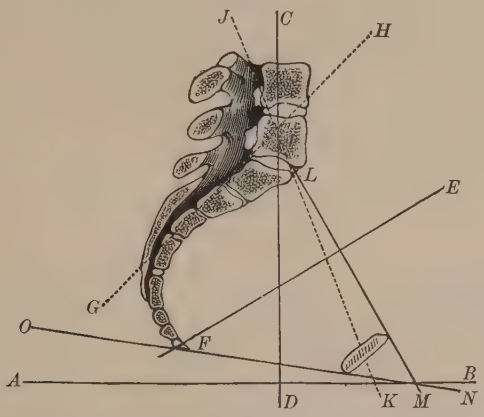
AXIS OF THE CHILD-BIRTH CANAL.
r Rectum. *a b*. Plane of outlet of completed canal. *e*. Perpendicular to plane or axis of expulsion.

a horizontal line an angle of 90°. Now let the body incline forward, the angle is lessened, and the axis approaches the axis of the inlet; now let the movement of the body be reversed, and the axis of the body is thrown further from that of the inlet. When the subject is standing, the plane of the outlet is nearly horizontal; but if she be lying on her back, the plane is almost vertical, and its axis is nearly a horizontal line; and from this fact the practical rule has been drawn, that in the

[1] This illustration, originally given by Dubois, is inaccurate in two or three respects. The antero-posterior diameter of the vulval outlet is represented as inferior to the coccy-pubic diameter, and the distance from the anus to the point of the coccyx is exaggerated, while that from the former to the vulval opening, by some known as the anterior perineum, is less than it is during the emergence of the child's head.

delivery of the head through the outlet by the forceps the pulling should be in a horizontal line.

FIG. 11.



RELATIONS OF PELVIC PLANES AND AXIS DUE TO CHANGES IN POSITION OF THE SUBJECT.

AB. Horizontal line. *ON.* Antero-posterior diameter of outlet. *FE.* Axis of inlet. *CD.* Vertical line. *HG.* Change caused by leaning forward. *JK.* By bending backward.

DIFFERENCES IN THE PELVIS AS TO THE INDIVIDUAL, SEX, AGE, AND RACE. *Individual differences.* As no two faces are exactly the same, so it is probable that no two pelves can be found which do not present some differences. Moreover, no pelvis is perfect in symmetry, form, and normal measurements. It has been said that as the perfect statue exhibits the separate perfections of many individuals combined in the artist's representation, so the perfect pelvis of the obstetrician represents a combination of the perfections derived from various pelves.

Without any positive deformity, and without such change in form as to present serious hindrance to labor, pelves differ in size. There may also be differences in the thickness of the pelvic bones, in their relative smoothness or roughness, in the height of the pubic arch, in the size of the angle, in the breadth, length, and curvature of the sacrum, in the depth of the iliac fossæ, and in the distance between the iliac spines or iliac crests. As a rule, the development of the pelvis corresponds with that of the lower limbs. It does not follow that a tall woman has a small pelvis; its development may be in perfect relation to her stature; if her labor be protracted, while that of another, whose stature is much less, be brief, the occurrence is to be attributed, as Dubois has said, to the fact that in the latter the pelvic canal is shorter.

Levret asserted that the circumference of the inlet was one-fourth the height of the individual. Finding the latter it was very easy to determine the former. But results have not proved the correctness of the assertion.

Weber sought to establish an analogy between the head and the pelvis. As heads present various forms, but can be reduced to four chief ones—viz., oval, round, conical, and square—so the various forms of the pelvis may be reduced to the same types, and these types coincide in the individual—that is, the pelvis corresponds in form with the head. Not only so, but certain measurements of

the head will represent pelvic measurements. Thus the measure between the zygomatic arches represents that of the transverse diameter of the superior strait, while its antero-posterior diameter is found by taking the distance from the root of the nose to the chin.

As observed by Depaul, this theory, if it were correct, would be of great service to the obstetrician; but, unfortunately, experience has not sustained it.

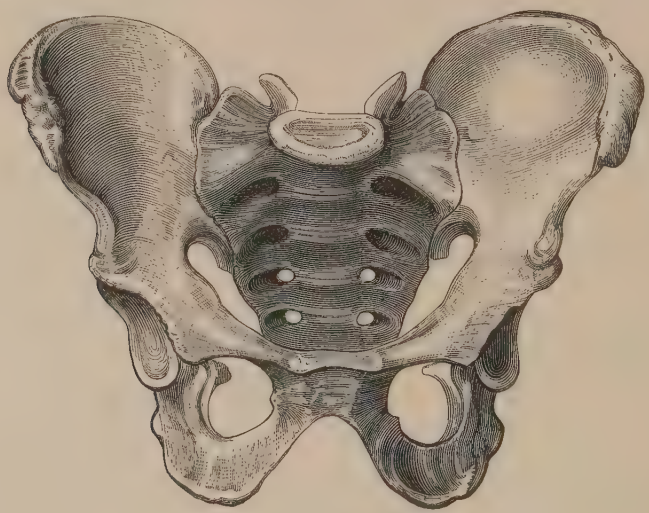
Kaltenbach[1] adopts the following classification of pelves:

1. The pelvic entrance has the shape of the truncated heart of a playing-card.
2. The pelvic entrance is transverse-oval.
3. The pelvic entrance is round.
4. The pelvic entrance is longitudinal-oval.

The pelvis of the Caucasian belongs to the first and second types; the pelvis of the American aborigines and of the Australian negro belongs to the third type; while that of the Bushmen and of the Malays is the fourth.

Differences in the sexes. Verneau[2] regards the sexual differences presented by the pelvis as much more positive than those of any other part of the skeleton, "although many of the differential characters commonly given are without value, such as the form of the ischio-pubic foramen, or are entirely false, such as the greater concavity of the sacrum in the female."

FIG. 12.



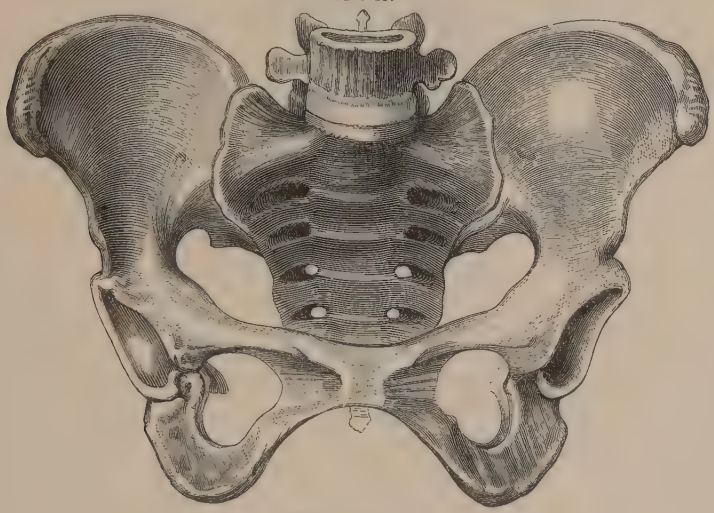
MALE PELVIS.

Of course, the pelvic bones, like the other bones of the skeleton, are in the male rougher, thicker, stronger, and less delicately curved than in the female. But there are many special characteristics which have been fully studied by Verneau. The most important of these will now be presented. The differences belong chiefly to the pelvic cavity, and are determined by the presence of the uterus. All the dimensions of the internal iliac fossa are less in the female, except the distance from the antero-superior iliac spine to the sacro-iliac joint. The fossa is more shallow in the female. In the male the iliac tuberosity is more devel-

[1] Lehrbuch der Geburtshülfe. [2] Op. cit.

oped and projects further back. The pubic spines are further apart in the female. In women all the diameters of the inlet are greater than in man. This difference is especially marked as to the transverse diameter. The inlet in the female pelvis is rounder, due partly to the increase in the transverse diameter and to the fact that the diameter is placed further forward than in the male pelvis. The great sciatic notch is less open and is deeper in man. In man, too, the points of the sciatic spines are in some cases within the postero-inferior iliac spines, but in women they are always without. The distance between the sciatic spines is greater in the female. The pubic arch is more open in woman,

FIG. 13.



FEMALE PELVIS.

measuring 75°; in man only 58°. In women it is always rounded; the ischio-pubic tubercle is turned more outward, and the ischio-pubic ramus is concave at its middle. In the female the coccyx and sacrum are not so high and are more flattened. The ischio-pubic foramen is not oval in man and triangular in woman;[1] in women it is relatively larger and more oblique outward and below. The ischia are wider apart in women, while all the vertical pelvic diameters are greater in man.

Thus, while there are marked distinctions between the male and the female pelvis, so that ordinarily there is no possibility of confounding the one with the other, yet in some instances[2] the points of difference are so slight that it is very difficult to decide whether a pelvis is male or female.

Differences depending upon age. The pelvis of the fœtus at term is much less developed than is the upper portion of the body; delivery is

[1] The late Dr. John Neill, of Philadelphia, proved this fact more than thirty years ago, though most works upon anatomy and some upon obstetrics still repeat the erroneous statement that the foramen is oval in the male and triangular in the female.

[2] Depaul. [3] Todd's Cyclopædia of Anatomy and Physiology.

therefore easier. The greater prominence of the abdomen in infants arises from the imperfect development of the pelvis; at birth the greatest portion of the rectum and the bladder are contained almost entirely in

FIG. 14.

PELVIS OF A CHILD.

the abdominal cavity, and do not assume their permanent position until about the period of puberty. At birth the false is more developed than the true pelvis; the latter is straight and cylindrical. According to Wood,[3] the *parallelism* of the lateral as well as of the anterior and posterior pelvic walls is sufficiently marked and general that it can be considered as a characteristic of the conformation of the infant pelvis, as is found to be the case with most of the lower animals, to which it imparts a square-sidedness. The antero-posterior diameter of the inlet is greater than the transverse diameter until the age of nine years, when the other equals, then gradually exceeds it. The complete development of the pelvis, which is not accomplished before twenty years, is largely dependent upon the presence and activity of the internal sexual organs; if these are absent or undeveloped, the pelvis fails to assume the characteristics of the female sex.

Differences dependent upon race. Some anthropologists have regarded the pelvis next in value to the skull as the indication of racial characteristics. Verneau suggests that it will one day be possible, by the comparison of pelves, to give, as by the comparison of crania, a classification of the human race.

The relative proportions of the conjugate and transverse diameters of the pelvic inlet present remarkable variations in different races, though, according to Professor Turner,[1] the form characteristic of the race is more fixed in the male than in the female pelvis, since in the latter there is, for sexual reasons, to a considerable extent, an approximation of form in different races. Nevertheless, the relation of these diameters has been chiefly studied in the female sex. In general, lessened transverse and increased conjugate diameters of the inlet seem characteristic of inferior races. Thus Garson,[2] incorporating the measurements given

[1] Journal of Anatomy and Physiology, vol. xx., 1885.

[2] Ibid., vol. xvi., 1882.

by Verneau with those made by himself, obtained an average conjugate of 106 millimetres in 49 European pelves, and a transverse of 134.5; while in 7 Australian pelves the average conjugate was 108.6, and the transverse 120. Verneau found that the pelvis of the Egyptian and that of the Laplander were each smaller than that of the French woman.

In no people,[1] however, has it been found that, where a sufficient number of pelves have been examined to make a just average, the conjugate exceeds the transverse diameter. Everywhere the form of the female pelvis indicates its part in labor when the fœtus is perfectly developed.

It is not improbable that a definite relation between the size and form of the fœtal head and those of the pelvis will be proved to exist in different races. With the progress of a race, with its greater intellectual and moral development, it is possible that there is a development *pari passu* of the pelvis. Broca has shown that the Parisian of to-day has a greater cerebral capacity than the Parisian of the twelfth century; and that the skull of the latter had a greater capacity than the skull of the Greek of the Macedonian period, skulls of this period exhumed at Athens within a few years showing a decided inferiority. Now it is at least a probable conclusion that if the head has thus increased in size, the bony canal through which it is transmitted at birth has undergone a corresponding increase. Nevertheless, Spiegelberg[2] has remarked that "the opinion that the further north a race is living the larger the pelvis, and also the other assumption, that an increase in size of the pelvis occurs with the increase of civilization of a race, are not proved; it would be more correct to state that favorable conditions of nutrition and activity are the basis of a well-formed pelvis."

Ploss[3] states that the habits and customs of a people and their mode of life undoubtedly have a certain influence in the formation of the prevalent pelvic type. The general nutrition, more particularly the supply of bone-forming material, is of importance. G. Fritsch found that a dwarfed, poorly developed pelvis bore a close relation to the general system of the Bushwomen and Hottentots. The pelves of the South African races present neither the typical male nor female form, but rather a combination of the male and female pelvis, as a rule approaching the male form. This results to some degree from the unfavorable conditions in which these people live, the entire skeleton never attaining that perfection found in a civilized people. It is asserted that the pelves of negresses born in America correspond more nearly to those of the European type, improvement of the general environment leading to better development of the entire osseous system.

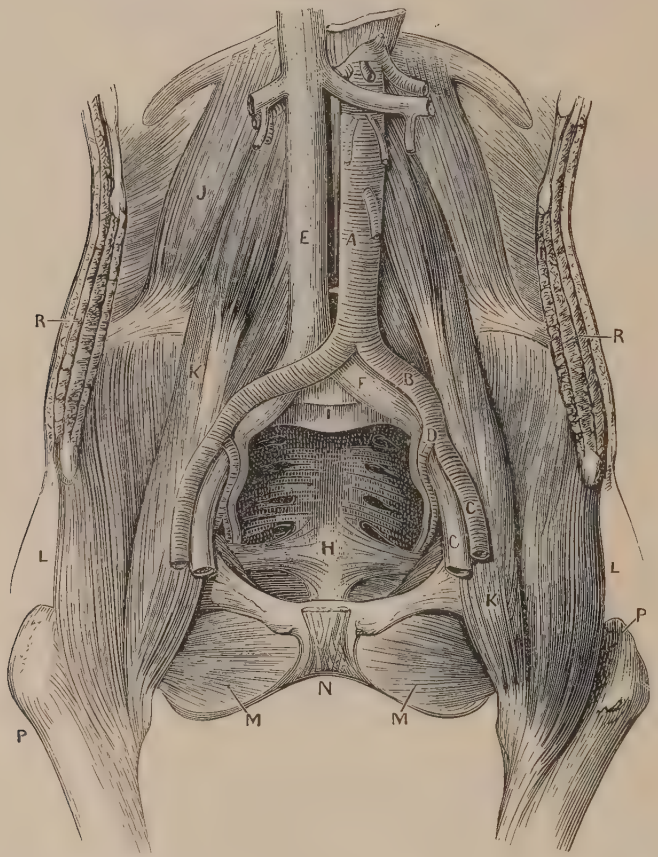
Soft Parts of the Pelvis. The structures which line the pelvis and those which chiefly make its inferior wall are called soft parts.

On either side of the upper pelvis the iliacus and the psoas muscles are placed. The iliacus covers the entire iliac fossa; it arises from the anterior two-thirds of the iliac crest, from the anterior iliac spines and the space intervening, from the sacrum, from the sacro-iliac joint, and from the ilio-lumbar ligament, and is inserted into the external border of the tendon of the psoas. The psoas muscle has its origin from the sides of the bodies and the transverse processes of the four upper lumbar vertebræ, and from the last dorsal, descends to the base of the sacrum, fills up the depression on each side of the promontory, and thick, spindle-shaped passes along the innominate line, receives the fibres of the iliacus, then goes out of the pelvis between the ilio-pectineal eminence and the inferior iliac spine, to be inserted into the entire surface of the less trochanter.

[1] Professor Turner.
[2] Lehrbuch der Geburtshülfe.
[3] Das Weib in der Natur und Völkerkunde.

An aponeurosis called the iliac fascia covers the iliacus and the psoas muscles; it divides into two layers, and thus furnishes a sheath for the iliac vessels and lymphatic ganglia. The external iliac artery and vein lie upon the internal border of the psoas. The lumbar plexus is placed in the substance of the muscle; its most important branch, the crural,

FIG. 15.



THE PELVIS, WITH SOFT PARTS. (Bladder, rectum, uterus and its appendages having been removed.)

A. Aorta. B. Primary iliac of left side. C. External iliac of left side. D. Internal iliac of left side. E. Inferior vena cava. F. Primary iliac vein of left side. G. External iliac vein of left side. H. Sacral insertion sacro-sciatic ligament. I. Sacro-vertebral angle. J. Quadratus lumborum. K K. Psoas muscles. L L. Iliac muscles. M M. External obturator muscles. N. Pubic arch. P P. Great trochanters. R R. Section of the muscles of the abdominal wall.

after emerging from the muscle, lies between it and the iliac muscle, and then passes from the pelvis below Poupart's ligament. It has been suggested that the presence of these nerves in the psoas explains the violent lumbar pains which women suffer in labor.

So, too, the pain felt at the inner part of the thighs, when the head of the fœtus descends through the inlet, is explained by pressure on the

obturator nerve at the base of the sacrum as it passes under the aponeurosis, this nerve furnishing branches to the adductors.

The psoas and the iliacus muscles acting from above flex and abduct the thighs; from below and on both sides they incline the lower portion of the spine and pelvis forward.

The iliacus muscle serves as a cushion upon which the gravid uterus rests. The psoas lessens the obliquity of the iliac bone and makes the slope to the superior strait more uniform. The two psoas muscles and the vessels at their internal border lessen the inlet. The diminution of the oblique diameters is only about one-eighth of an inch in each, but that of the transverse is three-fifths of an inch, or 1.5 of a centimetre. The diminution of the last diameter may be so great when the muscle is contracting as to prevent the entrance of the fœtal head.

In the pelvic cavity the pubic joint and the median surface of the sacrum and of the coccyx have no muscular covering; but on each side the obturator internus and the pyriformis muscles are found, the tendon of the former passing out of the pelvis through the less, the latter through the great sciatic foramen, notably contributing to the closure of these openings. The nerves of the sacral plexus lie in front of the pyriformis. The bladder is placed in the anterior part of the pelvic cavity, behind the pubis, but its position varies according as full or empty. The rectum enters the pelvic cavity in front of the left sacro-iliac joint—thus slightly lessening the left oblique diameter of the inlet—passes obliquely to the middle of the anterior surface of the sacrum, and then descends in front of the sacrum and coccyx. The soft parts in the cavity make but slight change in its capacity. A full bladder or rectum may hinder the descent of the head in labor, and therefore the obstetrician is careful that each organ is emptied.

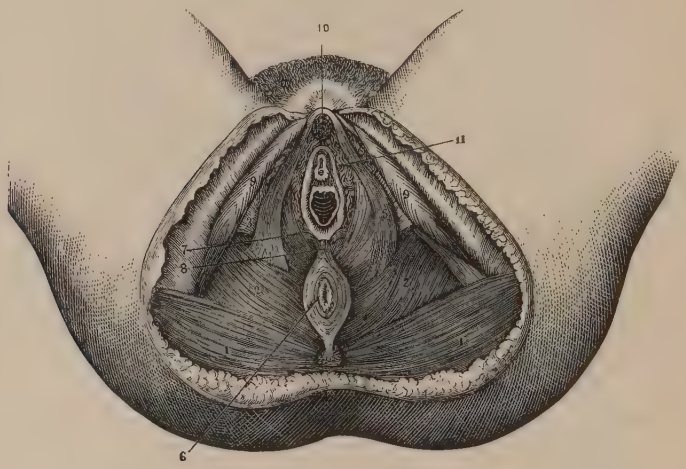
The Pelvic Floor. Skin, connective tissue, muscles, and layers of strong fascia unite to form the pelvic floor which contributes to the support of pelvic and abdominal viscera, and which at the same time is so formed that it may be temporarily opened almost to the bounds of the bony outlet, to permit the passage of the mature fœtus. This pelvic floor—diaphragm or inferior wall—is perforated by the urethra, vagina, and rectum; but these canals are closed, the first two by the accurate apposition of their walls, and the last by the contraction of the anal sphincter, unless when in functional exercise.

On examining the pelvic floor from within out we find, first, the superior pelvic aponeurosis, this aponeurosis being more or less covered, as all the pelvic organs are, by peritoneum. It is simply the united fascia of the pyriform, internal obturators, ischio-coccygeal, and levator ani muscles; it is attached to the posterior part of the pubic joint, to the upper part of the sciatic notch, and to the sacrum at the inlet, and it is continuous with the iliac fascia. Beneath this aponeurosis are placed the levatores ani and the two ischio-coccygeal muscles. The first has its origin, on either side, from the pubic ramus, the pelvic fascia, the ischial spine, and the less sciatic ligament; its fibres are inserted, first, at the base of the bladder, then in the vaginal walls, and in the coats of the rectum near the anus; the posterior fibres are inserted in a raphé extending from the tip of the coccyx to the anus.

The broad muscular band thus formed makes a diaphragm concave above, convex below, for the pelvic cavity. It raises the anal orifice and dilates it in defecation.

Budin, *Progrès Médical*, states that in exceptional cases the muscular fibres of the levator ani in the female may undergo remarkable development, so that its contractions can be readily felt by the finger in the vagina; in some cases making a tightly constricting circle, in other cases an elevation of the posterior wall of the vagina, so that it is drawn toward the anterior wall. In either case certain results may follow, such as difficulty or impossibility of sexual intercourse and delay in the escape of the fœtus.

FIG. 16.



UROGENITAL AND ANAL REGIONS IN WOMAN.

1. Gluteus maximus. 2. Levator ani. 3. Superficial transverse perineal muscle. 4. Profound transverse perineal muscle. 5. Vaginal sphincter muscle. 6. External anal sphincter. 7. Fasciculi of vaginal sphincter passing to the perineal body. 9. Ischio-cavernosus muscle. 10. Clitoris. 11. Bulb of the vestibule.

Dickinson (*American Journal of Obstetrics*, September, 1889) contributes a well-illustrated study of the anatomy and action of the levator ani muscle. By introducing cylinders of modelling wax into the vagina and having the patient voluntarily contract the muscle by straining, he studied the contractions, graphically, with the following results: The distance from the vaginal orifice to the inner edge of the levator averages less than half an inch (1.2 cm.). The double band of the muscle is always sharply defined. The more the levator is stretched the closer the strong edges of the horizontal belly are brought together. The contraction of the muscle crowds the penis against the cervix during coition; the vaginal outlet remains quiet, while the upper portion rises fifteen or twenty degrees toward the brim. A dynamometer test of the strength of the muscle gave an average of ten pounds, occasionally twenty-seven. It is especially strong in muscular and erotic women, in those with wide pelves, and in those suffering from painful lesions about the vulva and vagina.

He adds two cases of laceration of the pelvic floor which illustrate the efficiency of the muscle in preventing rectocele, and has collected five cases of labor delayed by the spasmodic contraction of this muscle, to which he adds one from his own observation.

The ischio-coccygeus is in the same plane as the levator ani, lying between it and the pyriform; it is triangular in shape, the base being

attached to the border of the coccyx and of the lower part of the sacrum, and the apex to the ischial spine. The two ischio-coccygeal muscles hinder the backward movement of the coccyx. They, with the anal levators, make the deep muscular layer of the perineal floor, and beneath the plane they form the anal sphincter is placed. This muscle has the form of an ellipse, the long diameter being antero-posterior; it arises by muscular fibres attached to the last bone of the coccyx and subjacent skin; these then form on each side of the anus a semicircular band, and, converging in front, are inserted in the perineal body. Beneath the sphincter is the skin.

The part of the pelvic floor thus described is called the posterior perineal region; it is triangular in form, the apex of the triangle being at the tip of the coccyx and its base a line between the ischial tuberosities. The anterior perineal region is included between the line just mentioned and the pubic joint. The pelvic floor is here formed of skin, fasciæ, and muscles. The latter are seven, viz., one vaginal sphincter and two ischio-cavernosi, two transverse perineal and two ischio-bulbous. The vaginal sphincter arises from the perineal body, surrounds the vaginal orifice, and is inserted upon the body of the clitoris and its suspensory ligament. The ischio-cavernosus has its origin on either side from the ischial tuberosity and from the ischio-pubic ramus, and is inserted by two tendinous expansions, one above and the other below the union of the crura of the clitoris. The transverse perineal muscles arise from the ischial tuberosities below the preceding, and are inserted in the perineal body. The ischio-bulbous muscle passes from the ischium on each side to the corresponding bulb of the vagina. Three aponeurotic planes are found in the anterior perineal region—the deep, the middle, and the superficial. Between the last two the muscles just described are placed.

Perineum. This part of the pelvic floor is of especial interest to the obstetrician. It is bounded by the anus behind, by the ischial tuberosities on the sides, and by the vulval opening in front. These limits apply to its external surface only. It has also a vaginal and a rectal surface, so that a median section of the perineum would in form resemble a spherical triangle.

The distance from the anal to the vulval opening is about three centimetres, or a little more than an inch, according to Spiegelberg. Foster[1] found that in the parous this measurement was rather less than an inch, 2.7 centimetres, but in the nulliparous somewhat more than an inch. The hypertrophy of pregnancy may increase this measurement to an inch and a half, or four centimetres. In labor the perineum may be so stretched by the presenting part as to measure five inches and a half, or fourteen centimetres. It is generally held that this distensibility depends "upon an irregularly limited mass of elastic tissue and muscular fasciculi situated midway between the posterior commissure of the vulva and the anus," known, since the investigations of Henle and Savage, as the perineal body. According to Savage,[2] the greatly stretched perineal body is the final covering of the presenting

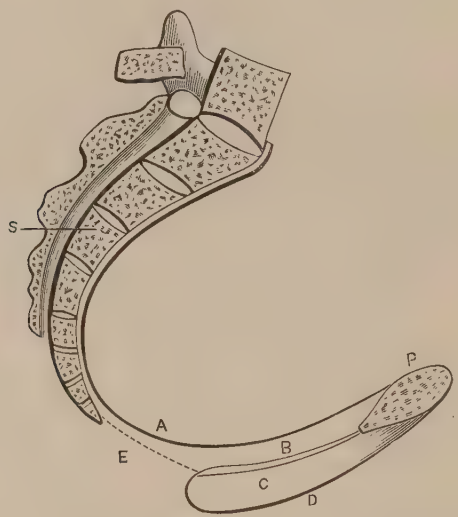
[1] American Journal of Obstetrics, 1880.

[2] Anatomy of the Female Pelvic Organs.

part. In very fat women the perineum does not yield readily in labor, and hence the liability to its rupture; while in some other patients it yields too readily, and its anterior margin is prolonged toward the pubic arch, while its central portion is so thinned that it may be perforated by the child's head, that is, a central rupture occur.

Pubic and Sacral Segments of the Pelvic Floor. The pelvic floor, in its relations to labor, is divided by Hart[1] into two parts, designated respectively the pubic and the sacral segment. The anterior vaginal wall is the posterior boundary of the former segment, and the posterior vaginal wall the anterior boundary of the latter segment. In labor the anterior segment is drawn up, while the sacral segment is forced down; and thus, as two doors meeting at their free border are opened, the one by drawing it toward the passenger, the other by pushing it from him, so the pelvic floor is opened for the transmission of the fœtus.

Fig. 17.



Antero-posterior Section of the Aponeuroses of the Perineal Floor.

S. Sacrum. A P. Pelvic aponeurosis. B. Deep perineal aponeurosis. C. Middle perineal aponeurosis. D. Superficial perineal aponeurosis. E. Connective-tissue layer which covers the lower surface of the levator ani behind the bis-ischiatic line, where it is fused with the posterior border of the deep perineal aponeurosis. P. Pubis.

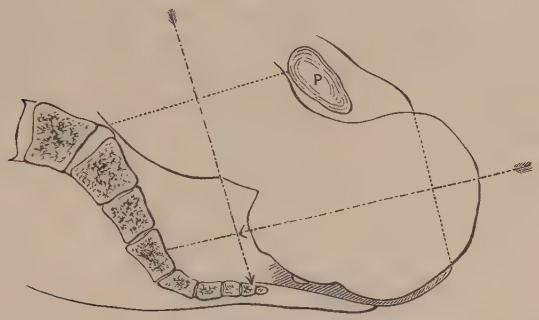
The vagina passes through the pelvic floor parallel to the conjugate of the inlet.

The Dynamic Pelvis. From the parallelism of the vagina, as it passes through the pelvic floor, with the antero-posterior diameter of the inlet, it necessarily follows that if the presenting pole of the fœtus enters the inlet in a line perpendicular to its plane, the emergence of that pole from the vagina will be in a line perpendicular to the prolonged previous line. Hence, according to the view of Boissard and some others, a curved line does not represent the line of direction taken by the pre-

[1] Female Pelvic Anatomy.

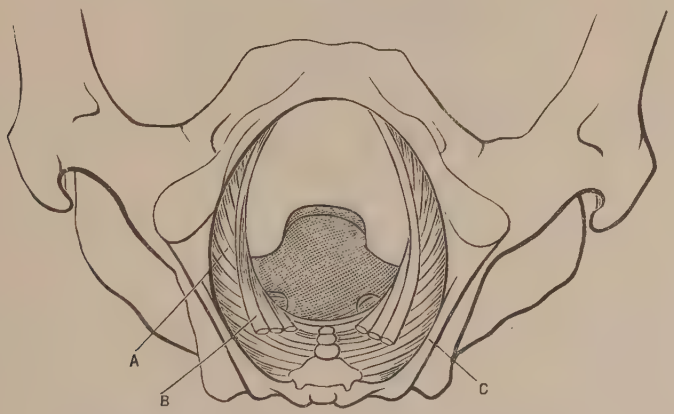
senting part in passing through the birth-canal, or the dynamic as distinguished from the osseous or static pelvis. Further, as has been shown by Fabbri and Pinard,[1] a cast of the entire pelvis—that is, of the bony pelvis with the membranous canal formed at the expense of the soft parts, a membranous canal channelled in all the thickness of the perineal floor, which is greatly developed at the period of expulsion,

FIG. 18.



connected with the former—will make it evident that the completed pelvic cavity is not a curved but chiefly a cylindrical canal. This cavity has its fundus at the coccyx, and the presenting part of the fœtus

FIG. 19.



A. Inferior external face of the levator ani. B. Precoccygeal fasciculi divided and separated. C. Great sacro-sciatic ligament.

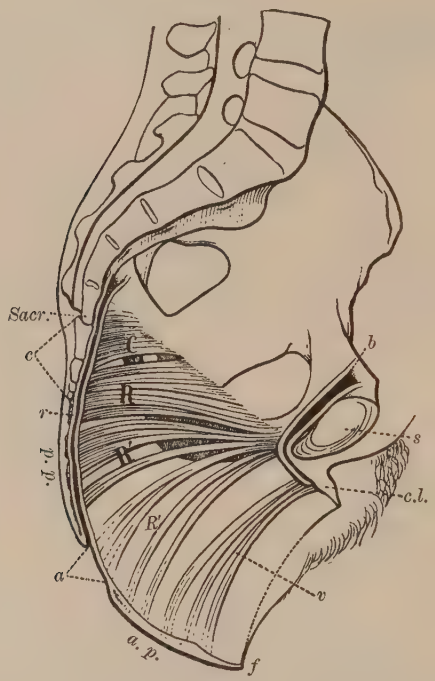
descends in a straight line to the fundus. The cavity is there closed, but presents an opening upon the anterior wall, and the line of direction now becomes one nearly perpendicular to that of descent.

THE GENITAL PORTION OF THE BIRTH-CANAL. By this name Farabeuf and Varnier[2] call that portion of the canal beginning at the

[1] Boissard: De la forme de l'Excavation Pelvienne. Paris, 1884.
[2] Farabeuf and Varnier: Introduction a l'étude clinique et a la pratique des Accouchements.

outlet of the bony pelvis and ending with the vulval orifice, traversed by the fœtus after passing out of the pelvic cavity. They call it, by antithesis, the soft or dilatable pelvis. It is funnel-shaped, the opening of this funnel being formed by the perineal muscular floor, that is, of the levatores ani and of the ischio-coccygeal muscles. On each side the soft basin is attached to the contour going from the lowest part of the body of the pubic bone to the point of the sacrum connected with the ischial spine, and the coccyx making a part. (See Fig. 19, in which the "diaphragm of the muscular floor of the pelvis, concave above, infundibuliform, and opening by a large median slit," is shown.)

Fig. 20.



Vertical Median Section of Pelvi-genital Canal. (Farabeuf and Vernier.)

The muscular fibres of the coccy-perineal levator. C. Ischio-coccygeal. R. Chief fasciculi at the point of the coccyx. R'R'. Other fasciculi of the levator separated in consequence of elongation of their line of perineal insertion. *b*. Bladder. *s*. Pubic symphysis. *c l*. Clitoris. *v*. Constrictor of the vulva. *f*. Fourchette. *a p*. Anterior perineum. *a*. Anus opened. *p p*. Posterior perineum. *r*. Rectum flattened. *c*. Coccyx pushed back. *Sacr*. Point of sacrum.

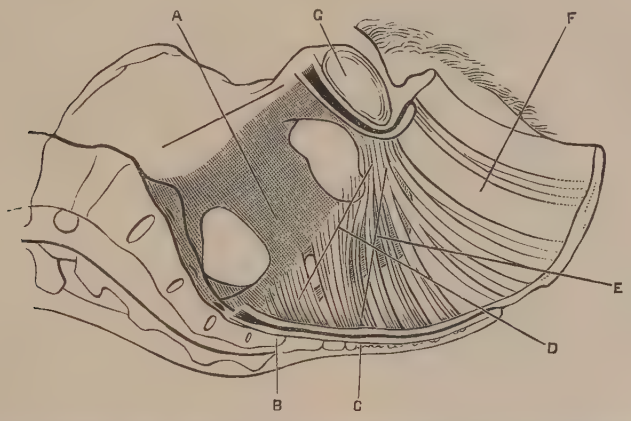
"This cleft may be called pubo-coccygeal, for the greater part of the fasciculi of the levator muscle is concentrated toward the coccyx." Its antero-posterior dilatability is limited by the degree of the retro-flexibility of the coccyx. In front its transverse dilatability permits it to equal the size of the bony pubic arch upon which it is inserted. Behind, it may be greater; but the fatty mass of the ischio-rectal fossa rarely permits the levator ani to be pressed upon the great sacro-sciatic ligament and the ischial tuberosity.

"Dilated by the fœtal part this cleft gains in length posteriorly, and in breadth at each side. It remains more extensive antero-posteriorly than transversely."

"Examined when the fœtal pole appears at the vulva, the perineo-vulvar passage forms the curved part of the pelvi-genital canal. As in the pelvic cavity, the anterior wall, the subpubic, is short, the posterior, perineal, very long." (Fig. 126, page 371, second edition.)

"This extends from the base of the coccyx to the vulval fourchette, and is greatly stretched; it may be 15 centimetres, 5.92 inches." "The pelvi-vaginal or pelvi-genital canal which the fœtus passes through is thus strongly curved, and embraces the symphysis with its concavity, like the curvature of a male vesical sound."

FIG. 21.



This is Fig. 20 (vertical median section of the pelvi-genital canal) placed in the obstetric position. A. Axis of the superior strait and of the pelvic cavity. G. Pubic symphysis. B. Point of sacrum. C. Coccyx pushed back. D. Axis of entrance into inferior strait. E. Axis of escape from inferior strait. F. Axis of the vulval strait.

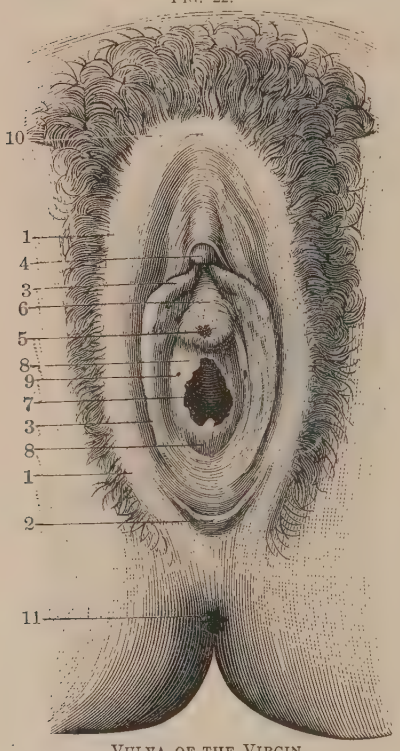
In explaining the axes of the entire birth-canal the authors state the conclusions to be drawn from a study of the subjoined illustration are that, if the accoucheur introduce his hand so as to grasp the presenting part of the fœtus, he will first draw below, toward his feet, in order to bring the part through the superior strait and descend into the pelvic cavity; subsequently he will still draw below, but toward his knees, in order that it shall enter and escape the inferior strait; finally, more and more upward, toward his head, for it to pass out of the vulval ring.

CHAPTER II.

THE FEMALE SEXUAL ORGANS.

THE female sexual organs are divided into those of generation and those of lactation. The organs of generation are the external and the internal.

FIG. 22.



VULVA OF THE VIRGIN.

1. Greater lip of right side. 2. Fourchette. 3. Small lip. 4. Clitoris. 5. Urethral orifice. 6. Vestibule. 7. Orifice of the vagina. 8. Hymen. 9. Orifice of the vulvo-vaginal gland. 10. Anterior commissure of greater lips. 11. Anal orifice.

THE EXTERNAL ORGANS OF GENERATION. These are included in the word pudendum or pudendum muliebre. Vulva[1] is often used as a synonym, though this term does not, strictly speaking, include the mons veneris.

MONS VENERIS. This is the upper part of the pudendum, and is bounded above by the hypogastrium, by the groin on either side, and by the greater lips below. It measures three inches from side to side, and two inches from above down—7.6 by 5 cm. A very large number of hair-follicles and sebaceous glands are found in the skin covering the mons. The growth of hair occurs at puberty, and hence the name for the bony part upon which the mons is placed. Beneath the skin there is a thick layer of connective and adipose tissue, which is traversed by fibres of elastic tissue passing in various directions. Some of these fibres are connected with the superficial abdominal fascia. Muscular fibres from the round ligament also enter this organ.

LABIA MAJORA. The greater lips, or alæ,[2] are two folds of skin passing from the median line and just below the mons veneris on each side of the vulval entrance to meet in the middle and anterior part of the perineum. Their junction above

[1] Vulva is from the word *volvo*, and was originally spelled *volva;* it meant the womb, or covering of the unborn animal. Vulva has no connection with *valva*, though the latter is derived from the same root.

[2] Winslow, in his Anatomy, says: "The ancients called the lateral parts of the cavity *alæ*, which is a more proper name than that of *labia*, commonly given them."

is about half an inch, or one centimetre and a half, above the clitoris, and is the anterior commissure. Their union below, or posterior commissure, is simply a fold of cutaneous tissue, marking the anterior margin of the perineum, and is called the fourchette. The depression between the fourchette and the hymen is the navicular fossa.

The external surfaces of the labia majora are convex and somewhat darker than the adjacent skin. They have an abundant supply of hair-follicles and of sebaceous and sudoriparous glands. The growth of hair, which, like that upon the mons veneris, occurs at puberty, is remarkable at the upper part, but lessens as the labia descend to the perineum. The internal surfaces of these organs are plane, somewhat pink or rose-colored, and in children, in virgins, and in the fleshy are in direct contact; but in those who have borne many children, in the old, and in the emaciated are separate, flabby, and relaxed, seeming like folds of dark and wrinkled skin, and expose the vulval entrance. The anterior borders are round and prominent, but become flattened and less distinct as they approach the posterior commissure. The posterior borders are attached to the ischio-pubic rami. Beneath the skin of the external surfaces and anterior borders of the labia there are found smooth muscular fibres forming that which Sappey has described as the dartos of the female, which is analogous to the dartos of the male. Each labium contains, according to Broca, a pyriform pouch, formed of elastic fibres, its large extremity being toward the posterior commissure, while its small end is directed to the inguinal canal. Sappey has described it as the elastic apparatus of the labia. The round ligament of the uterus, the analogue of the gubernaculum of Hunter, terminates in the labium majus. In some cases a prolongation of the peritoneum, forming the canal of Nuck, which is normally closed before birth, accompanies the ligament, and an accumulation of fluid in this canal may occur analogous to hydrocele of the cord, and frequently described as hydrocele of women. Connective and adipose tissue, bloodvessels, lymphatics, and nerves complete the structure of the labia. The superior commissure of the labia forms an arch over the clitoris and partially covers and protects this organ.

Labia Minora. Two folds of skin are found at the inner surface of each labium majus, beginning about the middle of the base of each greater lip, and are called the lesser lips or nymphæ. They extend above nearly to the clitoris, then each bifurcates; the lower divisions meet below the clitoris, but the upper, which are the larger, unite above this organ, forming the hood or præputium clitoridis. The nymphæ are rose-colored and are without hair-bulbs, sudoriparous glands, or muscular fibres. A layer of connective tissue, containing numerous elastic fibres and bloodvessels, unites the folds of skin of each nympha. The labia minora are remarkable for their sensitiveness and for their rich supply of sebaceous follicles. There are, according to Sappey, one hundred of these glands to every square centimetre of the external surface, and one hundred and twenty to one hundred and fifty to every square centimetre of the internal surface. While remarkably sensitive and thus concerned in copulation, the nymphæ are not erectile organs. In parturition they contribute to the enlargement of the vulval orifice.

The size of these organs is different at different ages. At birth they are quite prominent, because of the little development of the labia majora; at puberty the notable growth of the latter causes them to be hidden, though they also increase in size at that time, unfolding, according to the comparison of the Swedish botanist, Linnæus, like the petals of a flower. They may be elongated by traction, and thus lengthened and hypertrophied, measuring some five inches, 12.6 centimetres, or more, forming what has been called the apron of the Hottentots. If projecting beyond the labia majora, they become brownish—in negresses, for example, they are then as dark as the skin. They were supposed to direct the flow of the urine, and hence received the name nymphæ.

Among some of the Orientals the nymphæ are quite large, hindering the entrance of the penis, and their partial excision was the circumcision of females. Cuvier states that in the sixteenth century missionaries in Abyssinia persuaded their converts to abandon the custom, but as girls could no longer find husbands the Pope authorized a return to it.

The Clitoris.[1] Two crura, or branches—one attached to each ischio-pubic ramus — ascend and, converging, meet in front of the pubic joint to form the body of the clitoris, this body consisting of two corpora cavernosa, analogous to the corpora cavernosa of the penis. It is fastened to the anterior and inferior part of the pubic joint by a suspensory ligament. Sappey asserts that from its connection with the pubic symphysis and with the nymphæ change in its position or in its curvature is impossible. Its anterior portion, small and rounded, covered by the prepuce above and on each side, below by the inferior layers of the dividing nymphæ, is improperly called the glans—it has no orifice, no glandular structure. The dimensions of the clitoris vary in different subjects, but, according to de Sinéty, the average length is about three centimetres, or a little more than an inch. The mucous membrane[2] of the clitoris, especially that which covers the glans, is very rich in nervous papillæ, containing corpuscles of Krause and Pacini.

In the first three months of intra-uterine life the clitoris is relatively so large that a mistake in the sex of the product of abortion is liable to be made. So, too, hypertrophy of this organ in children and in adults explains some of the cases of supposed hermaphrodism.

The clitoris is the analogue of the penis; it is an organ concerned in copulation, but to regard it as the chief or exclusive seat of sexual passion is an error.[3] It has been asserted that the clitoris is hypertrophied by masturbation; but this is no more true than that males have hypertrophy of the penis from the same cause.[4]

The Vestibule. The nymphæ, diverging as they descend from the clitoris, make the sides of a triangle, the base being the intervening

[1] Three derivations of clitoris have been given: ¡First, from κλείω, to shut up, because concealed by the labia; second, from κλειδόω, to lock, the vulva being closed and the clitoris supposed to point to the keyhole; and third, from κλήτωρ, *Doric*, κλείτορ, one who invites, here the clitoris *quæ invitat ad coitum*.

[2] De Sinéty.

[3] The anatomist Colombus called this organ *veneris amor et dulcedo*. A recent obstetric author, Saboia, seems to adopt the same view, for he says that the clitoris is the chief organ of voluptuous feeling in the female.

[4] Winckel.

margin of the vagina, and to the space thus included the name of vestibule is given; the triangle is equilateral, each side measuring about one inch, 2.5 centimetres. Just above the middle of the base of the triangle the orifice of the urethra, *meatus urinarius*, is found; this orifice is circular and often presents an irregular, elevated, and rather firm margin, so that it may be recognized by the finger gently pressing upon it; there may also often be felt at the lower margin of the orifice a projection known as the urethro-vaginal tubercle.

Introduction of the Catheter. A flexible rubber catheter is usually preferred when artificial evacuation of the bladder is necessary; the beak of the instrument and the forefinger having been oiled, the latter is introduced into the vagina and its palmar surface placed upon the lower part of the anterior vaginal wall in the median line; the cathether is now passed along the upper surface of the finger until it touches the margin of the vagina, and then a slight elevation of the point of the instrument brings it in the mouth of the urethra. Another method of introducing the catheter, though in some cases very objectionable because of the great sensitiveness of the clitoris, is to pass the finger from above, separating the nymphæ, down the middle line of the vestibule about four-fifths of an inch, when the surface, hitherto smooth, becomes irregular, uneven, and the orifice of the urethra being felt, the catheter is readily passed.

When coition occurs in girls before the development of the sexual organs, it is not uncommon to find the urinary meatus hidden under the pubic arch, a partial inversion of the vulva having been produced; and a similar displacement of the meatus is sometimes found in posterior displacement of the gravid uterus. On the other hand, a reverse displacement of the meatus may be observed after a severe labor and consequent great swelling of the parts—the meatus is then further from the vaginal entrance and lies somewhat obliquely with reference to the normal position of the plane of the vestibule: very rarely, however, is exposure necessary for catheterization.

Hymen,[1] and Carunculæ[2] Myrtiformes. According to Budin,[3] the hymen as a distinct membrane does not exist; it is simply the lower end of the vagina, perforated like the extremity of the finger of a glove; or, it may be compared to the partially inverted and narrow fringed margin of a pantalette. But this view has not met general acceptance, and the following is probably the true explanation of the origin of the

[1] From ὑμήν, a membrane.

[2] Not given this name from their resemblance to myrtle-berries, but from their resemblance to myrtle-leaves, as stated by Winslow.

[3] Budin's statement is upheld by Dr. Gustave Imbert in a monograph upon the development of the uterus and vagina. Dr. Imbert says, referring to the hymen: In view of its structure some admit that this membrane is formed by a fold of the mucous membrane of the vagina; others, that it results from the vulval and vaginal mucous membranes being placed against each other. Properly speaking, the hymen is nothing but the anterior extremity of the vagina covered externally by the vulval mucous membrane; this is proved not only by histological examination, but by a dissection which shows the prolongation of the columns and the ridges of the vaginal mucous membrane upon its internal face and up to the orifice of the hymen. When the vagina is isolated from connected parts it appears as a canal ending in front by a perforated hemispherical part. Développement de l'Utérus et du Vagina, Paris, 1883. Dohrn states (Zeitschrift für Geburtshülfe und Gynäkologie, 1885) that the development of the hymen is closely connected with the increase in the length of the vagina, and that in proportion to this increase an excess of tissue is produced, which takes the form of a fold projecting over the vaginal entrance; as the posterior wall of the vagina exceeds in growth the anterior, the first beginning of the hymen is seen upon the former, and here it has a broader base, while the hymenal opening is nearer the anterior vaginal wall.

hymen :[1] About the nineteenth week of intra-uterine life the first trace of the hymen appears as a slight projection on the posterior wall of the vagina, just above the point where the vagina unites with the uro-genital sinus. A smaller projection then appears upon the anterior vaginal wall, but somewhat higher. The two soon unite at the sides. Papillæ are found upon the internal surface of the hymen, but its external surface is smooth, like that of the vestibule. It is composed of fibrillated stroma of connective tissue, has arteries and veins, and is rich in elastic fibres; muscular tissue is found in it, and the presence of nerves is proved by its exquisite sensitiveness in some cases. Winckel thinks its purpose is to prevent the entrance of amnial fluid into the genital canal during labor-pains. In some cases the hymen presents a crescent form, and apparently occupies only the lower portion of the vaginal entrance; again, it may be a membrane with a single central opening, or with several small perforations like a colander, or, finally, it may completely close the vagina, rendering discharge of the menstrual fluid or entrance of the penis impossible. Rupture of the hymen usually occurs at the first sexual intercourse, but it may result from other causes, thought it is impossible, as some have alleged, from any change of position of the lower limbs. If the vagina be large and greatly relaxed, the hymen may retain its integrity after repeated congress. In rare instances it has proved an obstacle to childbirth, and its incision been necessary. Only a few drops of blood usually follow its rupture, but in some cases a severe hemorrhage occurs.

The myrtiform caruncles, or hymenal tubercles, as Dubois termed them, are small fleshy tubercles, two to five in number, found after complete rupture of the hymen at the part of the vagina formerly occupied by its circumference. They are not seen, according to Schröder and Budin, until after labor, which converts the vagina and vulva into a common passage. They differ in size in different subjects, being so small in some as to be hardly visible, while in others they are relatively quite large.

Vulval Canal and Navicular Fossa. The vulval orifice is usually closed by approximation of the labia majora, but upon separating them a space is seen, shallow above at the vestibule, much deeper below at the posterior commissure, having somewhat the shape of a funnel, the smallest part being at the vaginal entrance; this is the vulval canal.

So, too, upon separating the labia there is distinctly seen in the nullipara, not, however, so apparent in the parous, a depressed surface extending from the fourchette to the hymen, or to the myrtiform caruncles; this depression has been given, from a fancied resemblance to a boat, the name of navicular fossa.

Vulval Glands. The glandular supply of the mons and of the greater and less lips has been stated; the richness of the nymphæ in sebaceous glands not only keeps these parts soft and pliable, but also guards them against injury from the contact of urinary and utero-vaginal discharges. But in addition to the glands previously mentioned

[1] Winckel.

there are other vulval glands to be noticed. Huguier has described four groups of muciparous follicles—though discredited by Sappey—vestibular, urethral, latero-urethral, and latero-vaginal. Skene,[1] in 1880, gave a description of two glands situated just within the meatus upon each side, near the floor of the urethra; these glands are from three-eighths to three-quarters of an inch in length.

The vulvo-vaginal glands—also known as the glands of Bartholin and of Duverney—are in the female the analogues of Cowper's glands in the male. They are situated at the sides and posterior part of the vaginal entrance, about two-fifths of an inch, or one centimetre, above the anterior face of the hymen or of the hymenal tubercles, and just below the bulb on each side.

They vary in size, in some cases as small as a pea, in others as large as a hazelnut; their usual form is that of a flattened ovoid. They are composed of lobes, lobules, and acini; from the acini canaliculi pass, which, lessening in number and increasing in size in their further progress, finally open in a single efferent duct. A covering of fibrous and connective tissue, sending prolongations between the lobes and lobules, invests each gland. These glands are lined with a cup-shaped epithelium closely resembling that of the glands of the cervical canal, and hence the similarity of the secretion, which is a tenacious, usually colorless fluid, that lubricates the vulval orifice and thus facilitiates coition. In some females the secretion is discharged in a jet, and this fact led to the long since rejected belief that woman as well as man furnished semen in coition, and the new being was the product of the united discharges.

Bloodvessels, Lymphatics, and Nerves of the External Sexual Organs. The arterial supply of these organs is by branches from the external and internal pudics and the epigastrics. The return of blood is chiefly through the external pudic veins. The lymphatic vessels communicate with inguinal ganglia.[2] The nerves are from the external pudic nerve and from the genito-crural and abdominal branches of the lumbar plexus.

The Internal Organs of Generation. The internal organs of generation are the vagina, the uterus, the ovaries, and the oviducts.

The Vagina.[3] The vagina is usually described as a musculo-membranous canal extending from the vulva to the uterus. From its continuity with the vulva it is an organ of copulation; and from its connection with the uterus it is an excretory canal for uterine secretions and the monthly flow, and through it as part of the birth-canal the fœtus with its appendages passes. It is placed behind the urethra and the bladder and in front of the rectum; it passes from the uterus obliquely from above downward and from behind forward. It forms an obtuse angle with the uterus when the bladder is full, but if the latter be empty, a right-angle. Its posterior wall is about four inches, or ten centimetres, in length, while its anterior wall is a little more than

1 American Journal of Obstetrics.

2 "It ought not to be forgotten that the superficial lymphatics of the groin have a double communication with those of the iliac fossa by vessels which pass through the cribriform fascia to reach the deep lymphatics, and by the ganglion which generally occupies the orifice of the inguino-crural canal."—*Siredey*.

3 Vagina means a sheath. The old anatomists called the vagina the cervix, and the ostium uteri; even Dionis and Mauriceau described it as the neck of the womb.

three inches, or eight centimetres. Ribemont-Dessaignes and Lepage *Précis d'Obstetrique*, 1893, state the length of the vagina anteriorly as 2.26–2.67½ inches, and posteriorly 3.17 inches. But these are only approximate measurements, for the length of the vaginal canal varies in different subjects and at different ages; it has been stated that in the negress this canal is longer than in the white woman; it is relatively longer in the newborn than in the adult,[1] the proportion to the length of the body being in the former one to nine, while in the latter it is one to fifteen.

When the organ is at rest the anterior rests upon the posterior wall, the two being in immediate contact, so that a section would represent a transverse slit, rather than a cavity. Nevertheless it is usual to refer to the vaginal diameters. The calibre of the vagina is least at the vulva and gradually increases as the organ ascends to the uterus, so that were the vaginal walls held apart it would represent not a hollow cylinder, but a hollow truncated cone, the base of the cone being above; the mean antero-posterior and transverse measurements are in the nulliparous from rather more than an inch to an inch and a half, three to four centimetres; in the parous two inches and a quarter to two inches and a half, or about six to seven centimetres. But in labor the vagina is so greatly stretched that these diameters become nearly equal to those of the pelvis.

The anterior wall of the vagina is in relation with the urethra, the bas-fond of the bladder, and with the ureters. The union between the vagina and the urethra, especially at the inferior portion of the latter, is very intimate, and interchange of fibres takes place; that between the vagina and bladder is of looser connective tissue, in which numerous blood- and lymph-vessels are found. Posteriorly the vagina is in relation with the peritoneum[2] nearly four-fifths of an inch, or somewhat less than two centimetres, the descent of the peritoneum from the posterior wall of the uterus to be reflected over the anterior wall of the rectum forming a pouch variously known as Douglas's, the recto-uterine cul-de-sac, and retro-uterine cul-de-sac. The subperitoneal tissue is here quite thin. Below the cul-de-sac the vagina is in relation with the rectum, but the connective tissue uniting the two above is quite loose, so that intra-peritoneal effusions may cause great descent of the peritoneal pouch. From the curving forward of the vagina below, and curving backward of the rectum, these organs are there placed further apart, so that a section of the recto-vaginal wall, made antero-posteriorly, would have the form of a triangle, its base extending from the anus to the vulva and its apex being immediately below the cul-de-sac. Laterally the vagina is in relation with the vaginal bulbs and sphincter, connective and fatty tissue, the anal levator, the lowest portion of the broad ligaments, and the pelvic aponeurosis.

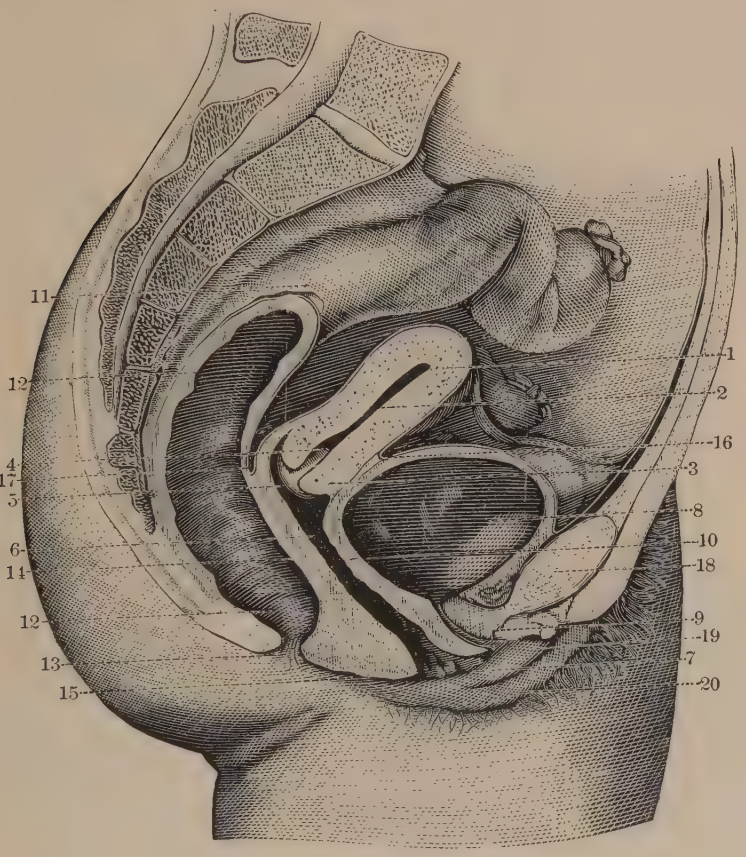
At its upper end the vagina is continuous with the uterus by means of muscular fibres common to the two organ and by mucous membrane passing from one to the other. This connection is made at the junc-

[1] Huschke.

[2] According to Bayer (Morphologie der Gebärmutter), the peritoneum may pass from the uterus at the same height upon the posterior as upon the anterior wall, and in such case, of course, the above statement would not be correct.

tion of the lower with the middle third of the uterine neck, a little higher behind than in front, and the neck is thus divided in two parts, one intra-vaginal and the other supra-vaginal; the former is by some called the *portio vaginalis*, or vaginal portion.

FIG. 23.[1]



SITUATION AND RELATIONS OF THE UTERUS.

1. Body of the uterus. 2. Cavity. 3. Neck. 4. Cavity of the neck. 5. Intra-vaginal part of the neck. 6. Vagina. 7. Vaginal orifice. 8. Bladder. 9. Urethra. 10. Vesico-vaginal wall. 11. Rectum. 12. Rectal cavity. 13. Anus. 14. Recto-vaginal wall. 15. Perineum. 16. Vesico-uterine cul-de-sac. 17. Utero-rectal cul-de-sac. 18. Pubic symphysis. 19. Small lip. 20. Great lip.

In consequence of the vaginal walls arching over to unite with the uterus a dome or vault, sometimes called the vaginal fornix, is formed;

[1] In taking this plate from Sappey some slight changes have been made so as to represent the vaginal walls nearer together. Nor does the illustration accurately represent the normal form and position of the uterus; these are correctly shown in Figs. 41 and 42, from Schultze, the bladder being empty. There is a physiological anteflexion of the organ, not represented in the illustration; moreover, according to Hart and Barbour, the anterior surface of the uterus rests upon the bladder; if the latter be full, the uterus is retroposed.

Van der Warker, as one of the conclusions of his study upon the Normal Position and Movements of the Unimpregnated Uterus, American Journal of Obstetrics, vol. xi., correctly states that the anatomical idea of coincidence between the uterine and the pelvic axes, maintained with more or less relative exactness, is obsolete.

this vault is divided into two lateral culs-de-sac, distinguished as right and left, and one anterior and one posterior; the last is the deepest.

The vaginal is continuous with the vulval canal below: as the union between the two is made at the narrowest part of each, a strait is formed which is in some cases the cause of serious delay in childbirth. The anterior and posterior walls of the vagina present transverse elevations, those on the former being more prominent than those on the latter. These elevations, sometimes improperly called *rugæ*,[1] are more distinct at the entrance of the vagina, and gradually lessen until they disappear a little above the middle of the canal; the so-called rugæ on the posterior wall in many cases ascend higher than those on the anterior wall. Labor temporarily effaces them, and after it, though gradually reforming, they are never so distinct as in the nulliparous. Two longitudinal elevations are formed at the junction of the transverse ridges in the median line, one on the anterior, the other on the posterior vaginal wall, that on the former being the more prominent, which are called the vaginal columns, and also the *columnæ rugarum*. The longitudinal and transverse elevations form what is called the *lyre*. Neither the columns nor the rugæ are directly opposite, and thus more complete apposition of the walls is secured. At the lowest portion of the anterior column a projection is observed, *tuberculum vaginæ;* this is important as a guide to the urethral opening, which is just above the tubercle.

Fig. 24.

Section of the Mucous Membrane of the Vagina, showing Cylindrical Cells.

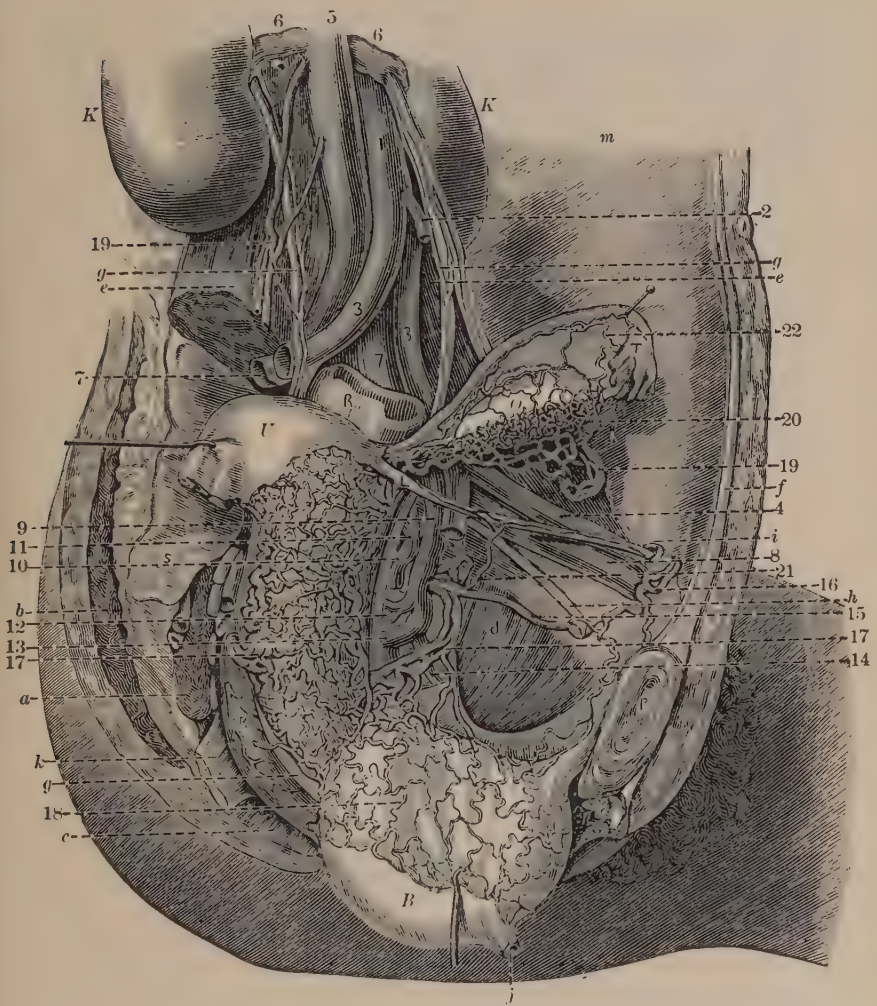
The walls of the vagina are from one-eighth to one-sixth of an inch, three to four millimetres, in thickness. They are composed of three coats or layers, the external fibrous, the middle muscular, which makes two-thirds of the thickness of the wall, and the internal mucous. The first is formed of connective tissue and elastic fibres; it contains large bloodvessel branches and nerve-tracts. It is in relation externally with the organs which encircle the vagina, and internally with the middle coat. The arrangement of the muscular fibres composing the middle coat is given differently by authors. According to Henle, the external layer is circular and the internal longitudinal; while Luschka gives a reverse disposition of these fibres, the longitudinal being external, the internal circular, and between the two oblique fibres are found. Tarnier describes the muscular fibres as inserted below in the ischiopubic rami and continued above with the middle of the three muscular layers of the uterus; some extend into the utero-sacral ligaments, and

[1] "These projections have been regarded as simply folds of the mucous membrane which are effaced in coition, and especially in labor. But they are not at all similar to folds. They are prolongations, elevated above the walls of the canal . . . . and do not contribute to enlargement of the vaginal cavity, but to coition."—*Sappey.*

others cross each other in all directions, leaving spaces occupied by venous enlargements.

The mucous membrane is pale red ordinarily, but during menstruation, and especially in pregnancy, becomes violet-colored. Very numer-

FIG. 25.



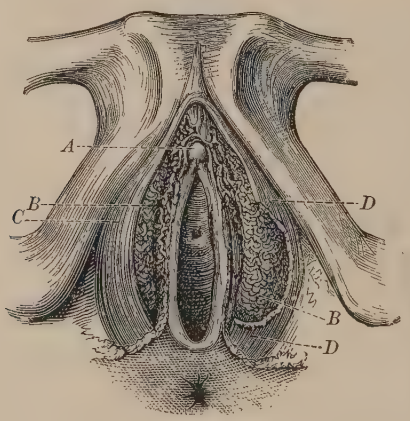
ARTERIES AND VEINS OF VAGINA AND UTERUS. (SAVAGE.)

B. Bladder cut at urachus and turned forward. R. Rectum. L. Round ligament. *U.* Uterus. *O.* Ovary. V. Vagina. S. Sacro-iliac articulation. *K.* Kidney. T. Fallopian tube. P. Pubic symphysis. *a.* Pyriformis muscles. *b.* Gluteal muscles. *c.* Ischio-coccygeus muscle. *d.* Internal obturator muscle. *e, e.* Psoas muscle. *f.* Linea alba. *g, g.* Ureters. *h.* Obturator nerve. *i.* Internal inguinal ring. 1. Abdominal aorta. 2. Inferior mesenteric artery. 3, 3. Common iliac arteries. 4. External iliac artery. 5. Vena cava. 6. Renal veins. 7, 7. Common iliac veins. 8. External iliac vein. 9. Internal iliac artery. 10. Gluteal. 11. Ileo-lumbar. 12. Sciatic. 13. Pudic. 14. Obturator. 15. Epigastric vein. 17. Uterine veins. 18. Vagino-vesical venous rete. 19. Spermatic veins. 20. Bulb of ovary. 21. Vein to round ligament. 22. Fallopian veins.

ous microscopic papillæ supplied with bloodvessels are found in the lower part of the vagina, but are scanty in the upper part. While it is commonly stated that the vaginal mucous membrane is covered with pavement-epithelium, according to v. Preuschen the lowest layer shows cylindrical epithelium. By Sappey and most other anatomists the presence of glands in the mucous membrane of the vagina is denied, but the investigations of v. Preuschen, confirmed by those of Ruge, seem to prove their existence. They are not abundant, and are similar in form to the sebaceous follicles of the vulva; in the superficial portion of the sinuous ducts pavement-epithelium is present, but deeper, as in a section of the mucous membrane of the vagina cylindrical epithelium is found, while in the remaining part of the gland both pavement and ciliated cylindrical epithelium occur.

Vessels and Nerves of the Vagina. The arterial supply is chiefly through the vaginal—derived from the anterior branch of the internal iliac—and from branches from the uterine, inferior vesical, and internal pudic. The veins, which are many and large, empty into the venous plexuses, situated at the sides of the vagina. The lymphatics of the lower fourth of the vagina, uniting with those of the vulva, communicate with the ganglia of the groin, while those of the remaining three-fourths enter the lateral pelvic ganglia. The nerves are derived from the hypogastric plexus.

Fig. 26.



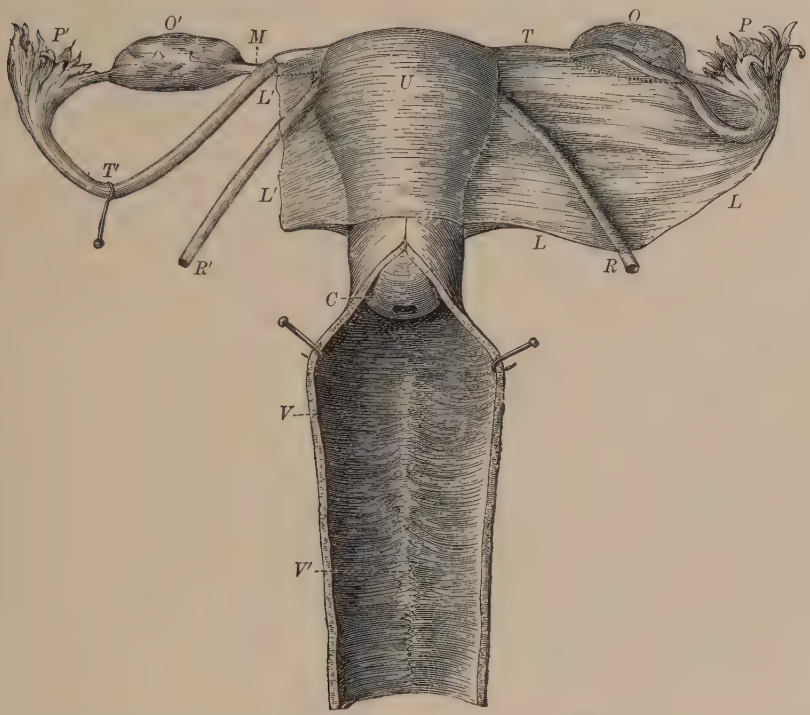
Bulbs of the Vagina.

A. Clitoris. *B*. Bulbs. *C, D*. Right and left halves of the vaginal constrictor.

The Bulbs of the Vagina. These are two erectile organs placed upon the anterior and lateral parts of the vagina; they are below and within the pubic rami, their internal concave surface embracing the vaginal orifice, their external convex surface being covered by the bulbo-cavernosus muscle. Above, the bulbs are united by veins and muscular fibres; the anterior borders have veins communicating with the veins of the nymphæ and of the clitoris. A bulb has been compared by Kobelt to a leech gorged with blood. According to Savage, a single bulb when filled with blood is an inch and a half long and

half an inch thick; while the measurements given by Sappey, and by Tarnier and Chantreuil, and by Charpentier are: length, one inch and one-tenth—thirty-five millimetres; breadth, half an inch—fifteen millimetres; thickness, three- to four-tenths of an inch, or ten to twelve millimetres.

FIG. 27.



INTERNAL GENITAL ORGANS.

C. Anterior part of the neck of the uterus. *L.* Broad ligament of left side. *L'.* Part of broad ligament of right side. *M.* Ligament of right ovary. *O.* Left ovary. *O'.* Right ovary. *P.* Pavilion of left oviduct. *P'.* Pavilion of right oviduct. *R.* Round ligament of left side. *R'.* Round ligament of right side. *T.* Left oviduct. *T'.* Right oviduct. *U.* Body of uterus seen from anterior face. *V.* Vagina opened from above below. *V'.* Middle column of posterior vaginal wall.

THE UTERUS. Womb,[1] *matrix*, from the Latin *mater*, Greek μήτηρ, μήτρα, German, Mutter and Gebärmutter. The Greek μήτηρ, the Latin *mater*, the Sanscrit *matri*, and German *Mutter*, show a striking analogy with the word "mut," which, according to the famous Egyptologist, Professor Ebers, was used in ancient Egypt as the name of the womb.

[1] The word womb was not at first employed to designate this organ of the female, but was used for the belly or abdomen. Thus, in Wycliffe's translation of the Bible, 1380, in the parable of the Prodigal Son, the translator states the fact that the prodigal would fain have filled his belly with the husks which the swine did eat, as he would have filled "his wombe," etc. In the same century Chaucer wrote his famous poems; and in the Squire's Tale, Canterbury Tales, the following passage is found:

"He kissed her, and clipped her full oft,
And on her womb he stroked her full soft," etc.

The word "clipped" is embraced. These quotations show how far astray those lexicographers are who have derived the word woman from womb-man.

The uterus is the organ in which the impregnated ovule is developed and by which the fœtus and its appendages are expelled from the mother's body when the development is complete; it is, therefore, the organ of gestation and the organ of parturition. It is situated in the pelvic cavity with its fundus usually just below the plane of the inlet; it is behind the bladder and in front of the rectum, while at its sides are the broad ligaments which pass from it to be attached to the lateral walls of the pelvis. The uterus has been by some described as pear-shaped, and by others as resembling a gourd; that portion which lies above the reflection of the peritoneum over the posterior wall of the bladder presents somewhat the form of an inverted truncated cone, while that which is below is cylindrical. A slight depression or constriction upon its external surface, more distinct in the virgin than in the parous uterus—more distinct, too, anteriorly than posteriorly—known as the isthmus, marks the separation just mentioned; all that part of the organ above the isthmus is called the body, or corpus, while that below is the neck, or cervix. If a line be drawn from the uterine end of one oviduct to that of the other, the portion of the body or corpus above this line is known as the fundus. In infancy and in childhood the uterus is small, but it is remarkably developed at puberty; it is atrophied after the menopause; it is temporarily increased in size, one-half or more, during menstruation; it is larger in the parous than in the nulliparous, larger, too, in the married than in the virgin. The virgin uterus is about two inches and a half, or seven centimetres, in length, its greatest lateral measurement is about one inch and a half, or four centimetres, and its antero-posterior measurement is nearly one inch, or two and five-tenths centimetres.

Its weight in the nullipara is from eight to ten drachms, or thirty-two to forty-two grammes. The weight of the parous uterus is from one-fourth to one-third greater.

The anterior face of the uterus is triangular, somewhat convex; the posterior face is also triangular, and its convexity is quite marked; its superior border is convex from before back, nearly straight from side to side in the nulliparous, but convex in the parous uterus; the sides curve somewhat inward from above down, and are convex from before back. The angles of the uterus mark the union of the superior border with the lateral borders; they also correspond with the attachment of the oviducts. The lower end of the body of the uterus is continuous with the upper end of the neck, the isthmus marking the place at which one passes into the other.

The relative proportions of the body and the neck differ in the child from those in the adult; so, too, this relation differs in the nulliparous and in the parous. In the child at birth, and for the first following years, the neck is three-fifths of the entire organ, but in the nulliparous only a little less than half; in the parous the body is three-fifths to two-thirds the entire uterus.

The cervix in the virgin has nearly the form of a cylinder; it is, however, somewhat enlarged in the middle like a barrel, and flattened from before back, so that the antero-posterior diameter is a little less than the transverse. It is commonly stated that the upper third of the

anterior surface of the cervix is covered by peritoneum, while the middle third is attached to the bladder; the investigations of Bayer, however, show that the peritoneum is usually reflected from the anterior wall of the uterus at a point corresponding with the internal os uteri, and, therefore, this membrane does not cover any portion of the cervix anteriorly. The vaginal portion of the neck—its lower third—in the virgin is smooth; as it descends it lessens in size and is rounded at its lowest part; in the middle of this rounded part an opening, the os uteri, is found having usually the form of a short transverse slit, which becomes circular when mucus or blood is expelled; to the finger it feels like a simple depression. In the normal form of the virgin cervix any division of the tissue surrounding the mouth of the womb into an anterior and a posterior lip is purely arbitrary, in most cases nothing can be seen or felt but a uniform unbroken border; the distinction of anterior and posterior lip is almost invariably the result of a traumatism in labor, and the traumatism is usually physiological, not pathological. In quite rare cases, however, labor may occur without any tears of the os, so that the latter retains its virgin character. So, too, in some cases in which the fashionable operation for laceration of the cervix has been done, the skill of the operator may have perfectly restored the original form of the os. Hence, an obstetrician, finding an os with the virgin form, in consequence of no tear having occurred at childbirth, or because perfect restoration has been made by an operation, may erroneously conclude that the subject has never borne a child. The cervix in the parous is not conical as in the virgin, but often club-shaped, the mouth larger, and fissures can be seen and felt, the most distinct usually being transverse; that upon the left side is more invariable and generally more distinct, and its greater depth and more uniform presence are explained by the greater frequency of left occipito-anterior positions. Childbearing also shortens the neck of the womb, and in a woman who has had many children the vaginal portion of the neck may be so lessened as scarcely to project in the vagina.

The cavity of the uterus is divided into that of the body and that of the neck, the dividing-line being a narrowed part corresponding internally with the isthmus externally; this internal narrowed part is known as the *os uteri internum*, the internal mouth of the womb.

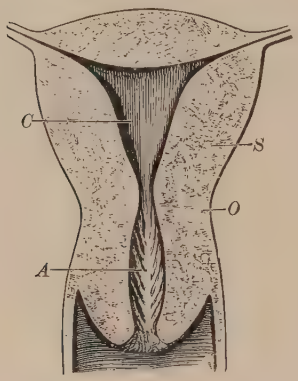
The Cavity of the Body of the Uterus. The cavity of the body of the uterus is triangular, the angles being at the entrance of the oviduct on each side and at the internal os uteri. The sides of this triangle are convex, the curve being toward the centre of the cavity in the nulliparous; the sides are straight, or even curved somewhat outward in the parous. The anterior and posterior walls are in contact, or else separated by only a thin layer of mucus. The capacity of the uterine cavity in the nulliparous is from 2 to 3 cubic centimetres, or 32 to 49 minims; in the parous 3 to 5 cubic centimetres, or 49 minims to 1 drachm 21 minims.

The Cavity of the Neck. The cavity of the neck is fusiform; but this character is less distinct in the parous than in the virgin. The anterior and posterior walls have each a longitudinal projection, the two projections not, however, directly opposite; from each of these as a

central axis similar projections, *plicæ palmatæ*, pass obliquely on either side; each axis with its branches forms an *arbor vitæ—arbor uteri vivificans* was the name given it by the old anatomists. In addition to the median ridges or columns, there is one on each side at the junction of the anterior and posterior walls.

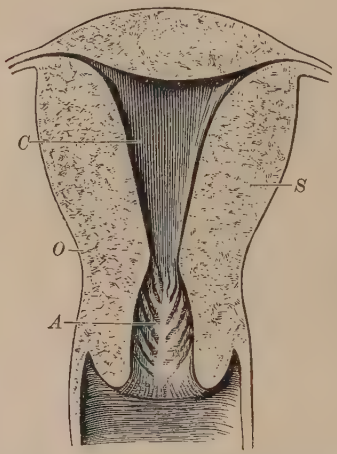
The Structure of the Uterus. The walls of the uterus are composed of an external serous, an internal mucous, and a middle muscular coat. The thickness of the uterine parietes varies at different parts from four-thirteenths to seven-thirteenths of an inch, eight to fifteen millimetres; the wall is thinnest at the entrance of the oviducts, thickest at the sides.

Fig. 28.



Transverse Section of a Nulliparous Uterus.

Fig. 29.



Transverse Section of a Multiparous Uterus.

A. Cavity of the neck and arbor vitæ. *C.* Cavity of the body. *O.* Isthmus separating body and neck. *S.* Uterine tissue.

The Peritoneal Coat. All the uterus is covered with peritoneum except its borders, that part which is within the vagina—that is, the vaginal portion, the part connected with the bladder, and that to which the vagina is attached. The union is so intimate upon the anterior and upon the posterior face of the uterus that even a small part of the serous cannot be removed without taking away also a thin layer of muscular tissue. The peritoneum is reflected from the uterus in front over the bladder, and in this reflection the vesico-uterine cul-de-sac is formed; its reflection posteriorly over the rectum forms the retro-uterine cul-de-sac, the lowest portion of the peritoneal cavity; laterally the anterior and posterior layers of the peritoneum which include the uterus meet to form the broad ligaments.

In some cases the posterior peritoneal reflection begins upon that part of the posterior surface of the cervix which corresponds with the internal os; in most, however, the peritoneum descends so as to be in relation for a short distance with the upper posterior vaginal wall, and then is reflected over the rectum.

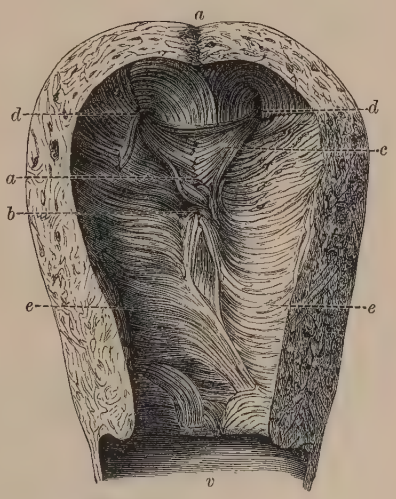
THE MUSCULAR COAT. This is the most important of the three, and makes almost the entire thickness of the uterine wall; the uterus is, in fact, a hollow muscle. The muscular tissue of the non-pregnant uterus is firm, resisting, has a grayish or reddish-gray color, and when cut creaks like firm fibrous tissue. But this organ in pregnancy shows marked changes in its muscular substance. The tissue is now softened, very vascular, and red; in consequence of both hypertrophy and hyperplasia its muscular character has become quite distinct.

Most authors describe the muscular wall of the uterus as composed of three layers—one external, a middle, and an internal. The usual description will be briefly given first, and then some results of recent studies of this wall will be presented.

FIG. 30.

EXTERNAL MUSCULAR LAYER OF POSTERIOR WALL OF UTERUS.

FIG. 31.



INTERNAL MUSCULAR LAYER.

a. Section of uterine wall. *b*. Triangular bundle. *c*. Fibres returning to the tubes. *e, e*. Transverse fibres. *v*. Vagina.

The external layer is formed by alternate planes of transverse and longitudinal fibres.

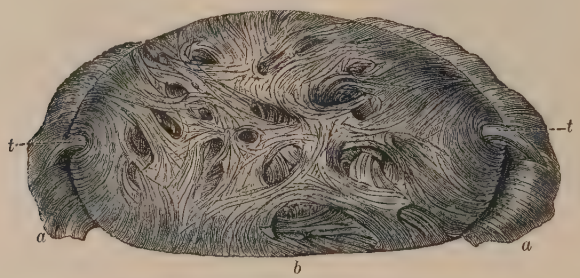
On the posterior wall transverse bundles are found beginning at each side at the level of the isthmus; running across toward the median line, they then turn abruptly to become longitudinal; fresh accessions to the latter come from the inflection of other fibres from either side in the ascent from the isthmus toward the fundus. The median portion of the bundles of longitudinal fibres pass over the fundus, but the fasciculi cross each other, those from the left passing to the right, and similarly the right passing to the left, to descend upon the anterior wall; the lateral bundles pass off to the broad ligaments and to the oviducts.

The deep or internal layer is chiefly formed of orbicular fasciculi, having the openings of the tubes as centres, and arranged in concentric circles. At the level of the isthmus more or less complete rings are

found, making a sphincter. There also enter into the formation of this coat two triangular fasciculi—one on the anterior, the other on the posterior wall; the base of each triangle is at the fundus and its apex at the isthmus; these fasciculi begin in transverse fibres below and end in transverse fibres above, so that the general course of the twice-inflected fasciculi is represented by the letter Z; but the course of the fasciculi upon the anterior wall is the reverse of that of those upon the posterior wall—that is, it would be represented by an inverted Z.

The middle layer, found only in the body of the uterus, is as thick as the two others united. Tarnier gives the following description: It is composed of bands of variable size which cross each other in every direction; some are transverse, others oblique, some longitudinal; large apertures, traversed by veins and sinuses, separate these bands from each other, or separate the fibres of the same band. Muscular fasciculi are curved around the uterine veins (the arciform fibres of William Hunter, 1772; fibres *in anse* of Calza, 1807), and each curve crossed by another forms with it a complete ring which encircles the vein. A series of these rings makes a canal for the vein. Large rings, similar in their formation to the preceding, encircle several veins at a time, and each of the latter in the chief ring also has its own ring. Most frequently the curved fasciculus forms only one-half or two-thirds of the circle, which another fasciculus completes by crossing the first, with which it is intimately united. Each venous vessel is thus surrounded by contractile annular fibres, and passes in a true contractile canal in all its course through the middle layer.

FIG. 32.



MIDDLE MUSCULAR LAYER AT THE FUNDUS.

a, a. Superficial layer dissected back. *b.* Branches belonging to the inner layer. *t, t.* Tubes.

The muscular tissue of the neck is derived solely from the external and from the internal layers. Its superficial muscular plane is formed exclusively of transverse fibres, the fasciculi crossing each other at the median line according to Schwartz; but Tarnier and others describe them as passing somewhat obliquely. Muscular fibres pass from the neck to the vagina, to the utero-sacral and to the utero-vesical ligaments. Immediately beneath the mucous membrane of the cervical canal fibres of muscular tissue are found. The projections of the *arbor vitæ* are for by muscular fasciculi, whose fibres separate on each side in making the superposed arches.

Bayer, from a very careful microscopic study of the muscular struct-

ure of the non-gravid uterus, has been led to the following conclusions:[1]

1. The internal longitudinal fibres of the oviducts form the largest part of the submucous muscular layer of the uterus, while their external longitudinal layers form a part of the external layer. The circular fibres of the oviducts assist in the formation of the middle muscular layer of the uterus.

2. The greater portion of the muscular tissue of the lower pole of the uterus and of the cervix is developed from the *retractors*.[2]

The lowest and thickest part of the posterior wall of the corpus, a thinner and higher zone on the anterior wall, the whole of the lateral wall of the cervix, as well as the anterior lip, and the portion of the cervix immediately above it, may be traced to this origin.

3. The remaining portion of the uterine fibres is derived from the radiating fibres of the round ligament, and, indeed, the chief mass of the posterior wall of the body from the retractors; and the muscle bundles surrounding both angles of the womb in diverse layers are derived from the ovarian ligament; on the other hand, the external layer of the anterior wall and the lower part of the cervix and the entire supra-vaginal part lead back to the round ligament. The middle layer of the body is formed by both ligaments in common.

It will thus be seen that a general division of the muscular mass of the womb into three or more layers is not feasible, since the arrangement of the muscular layers is diverse in different parts of the uterus. Its construction can only be understood by examining the several portions of the uterus separately.

1. The fundus is composed of—

(*a*) A superficial layer, the median longitudinal fibres of which pass from in front back, while the lateral fibres are arranged in whorls around the insertions of the oviducts; these whorls pass from left to right around the right tube, from right to left around the left tube, compared with the direction in which the hands of a watch move; a hood-like covering is thus formed, probably arising from the external longitudinal layer of the oviduct, and of the round ligament.

(*b*) Of the deepest, or submucous layer, arranged in the same manner as the above, and derived from the internal longitudinal fibres of the oviduct.

(*c*) Of a middle layer, which is derived from the round and from the ovarian ligaments, a broad band, anteriorly and posteriorly, on both sides of the median line, passing in a sagittal direction. This is interlaced with transverse bands from the circular fibres of the oviducts. Fibres from the ovarian ligament, in connection with the latter, surround the horns of the uterus in spirals and obliquely placed circulars.

2. The posterior wall is formed by the circular fibres of the oviduct, by diagonal lamellæ from the ovarian ligament, which pass inward from above, and, finally, by the eccentric rings coming from the retractors, which penetrate all the layers. In this description the most superficial and the deepest longitudinal fibres originating from the oviducts, and which unite to form anteriorly and posteriorly a triangular muscle, are omitted.

3. The middle part of the anterior wall may be divided into an external longitudinal layer, which arises from the muscular fibres of the

[1] Morphologie der Gebärmutter. Freund's Gynäkologische Klinik. Strassburg, 1885.
[2] See description of the utero-sacral ligaments.

round ligament, united with the longitudinal fibres from the oviduct; a middle layer formed by the union of circular fibres from the oviduct with the anterior rings of the retractors, and an internal longitudinal layer formed by the crossing anteriorly of the inner longitudinal fibres of the oviducts.

4. In the lower part of the body, the greater part of the walls is formed by muscular bands from the round ligament.

5. In the internal and external portion of the cervix longitudinal fibres, which are the continuation of the corresponding layers of the corpus, anteriorly and posteriorly pass in the median line. Beside this, the posterior wall of the cervix essentially consists of eccentric rings of the retractors, the interlacing fibres of which form other parts, and finally, externally of fasciculi from the ovarian ligaments, which after passing longitudinally are inflected.

In the anterior wall of the cervix only muscular lamellæ, running diagonally toward the mucous membrane, and covering each other like the tiles of a roof, can be recognized; the fibres of the retractors are found more especially in the lower third, forming a compact muscular mass by interlacing with the radiating fibres from the round ligament.

Bayer remarks that if these manifold convolutions of the muscular fibres make the picture of the uterus a very complicated one, the vessels which pass in every direction and render the preparation of the muscular layers exceedingly difficult, render it still more complex. The most vascular portions are the posterior and lateral walls of the corpus and the entire posterior wall and the anterior lip of the cervix.

Fig. 33 represents the internal surface of the uterus exposed by an incision through the middle of the anterior wall. The uterine portion of each oviduct is seen, surrounded by a system of circular fibres which pass anteriorly and posteriorly into a median strip of longitudinal fibres. The lower portions of the sides are covered with horizontally arranged circular segments which project sharply above the level of the surface, and turn slightly upward as they approach the median line above mentioned. Careful examination shows that the posterior longitudinal fibres go outward, and the lateral fibres, after passing toward the horn of the uterus above the opening of the oviduct, curve around it and enter its wall at the lower margin. The anterior median line of fibres, however, arches under the orifice of the oviduct, and these fibres disappear in the posterior and upper margin. The middle or central fasciculi pass directly over the fundus, in vertical arches, to the posterior wall. The circular systems around the orifices of the oviducts, therefore, appear to be composed of two spiral systems which wind around

Fig. 33.

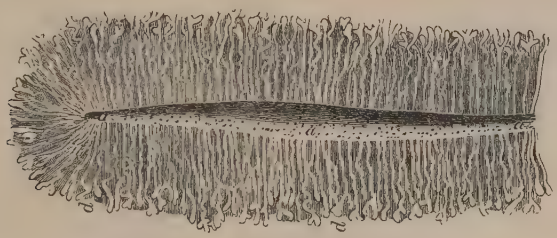
Internal Surface of the Uterus, as shown after Incision in the Median Line of the Anterior Wall.

from the interior of the oviduct toward the anterior and posterior walls of the corpus.

These fibres describe only a semicircle about the orifice of the oviducts, and it is by the union of the two systems that complete circles are formed.

The Mucous Membrane of the Uterus. The mucous membrane of the body differs from that of the neck, and will be first described. It is a pale pink in life, but becomes a grayish color after death, and is moist from its abundant glandular secretion. It has a thickness of 0.039 to 0.078 inch, two to four millimetres, in the virgin uterus, 0.23 to 0.31 of an inch, six to eight millimetres, in the parous uterus; it is thinner in the vicinity of the entrance of the oviducts than elsewhere. It is greatly swelled during menstruation, so that its thickness is two or three times greater. Its free surface is smooth, and upon it the mouths of the uterine glands open; these glands are so numerous that their openings occupy nearly one-third of the entire surface.

Fig. 34.



Glands of the Body of the Uterus.

a, a. Free mucous surface of the uterus, with mouths of glands opening in it. *d, d.* Glands.

The mucous membrane is so intimately attached to the muscular tissue that it is impossible to separate them; there is, according to Cadiat, an actual reciprocal penetration.[1] A single layer of cylindrical ciliated epithelium is found upon the free surface; the movements of the cilia are from the mouth of the uterus toward the oviducts. Beneath this there is found amorphous matter containing a large number of fibroplastic bodies.

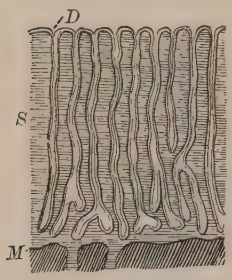
Utricular Glands. These glands are cylindrical and flexuous. Engelmann states that they are often bifurcated at their lower third, but according to de Sinéty they are rarely bifurcated, and Sappey describes them as generally single, sometimes bifid or trifid. They are lined with ciliated epithelium, and secrete a transparent, alkaline, fluent mucus.

Mucous Membrane of the Neck. This is whiter, thinner, and of firmer consistence than is that of the body. Cylindrical epithelium with vibratile cilia is found in the upper two-thirds, but in the lower third pavement-epithelium. The borders of the elevations caused by the *arbor vitæ* are lined by ciliated epithelium. But in passing from the free borders to the sides of the elevations referred to, the ciliated

[1] Schwartz.

is replaced by cup-shaped epithelium which becomes more and more developed as it penetrates more profoundly into the numerous glands situated at the fundus of a mucous fold.[1] The glands, which are so abundant in the cervix that Spiegelberg calls it a great gland apparatus, are not tubular, like those of the corpus, but racemose. The glands of the cervix secrete a thick, viscid alkaline, gelatin-like mucus; it forms the gelatinous plug that in pregnancy is frequently found filling the cervical canal. No glands are found at the level of the external mouth of the womb. Obstruction of the excretory duct of one of the cervical glands gives rise to retention by the accumulation of secretion; and such cysts are known as ovula Nabothi, because of Naboth's error in regarding them as human eggs.

FIG. 35.



VERTICAL SECTION OF THE MUCOUS MEMBRANE OF THE VIRGIN UTERUS.

S. Mucous membrane. *D.* Uterine glands. *M.* Muscular stratum.

FIG. 36.

EPITHELIUM WITH VIBRATILE CILIA. (350 Diameters.)

a. Nucleus. *b.* Nucleolus. *c.* Body of the cell. *v.* Vibratile cilia.

FIG. 37.

EPITHELIUM WITH CUP-SHAPED CELLS. (350 Diameters.)

a. Nucleus. *b.* Nucleolus. *c.* Body of the cell forming a cavity.

Beneath the epithelium there are fibrous[2] laminæ which are continuous with those interposed between the muscular fasciculi, and hence the intimate union between the mucous membrane and the subjacent tissue.

BLOODVESSELS OF THE UTERUS. The four chief trunks supplying blood to the uterus are the two uterine and the two ovarian arteries. The two latter, which correspond to the spermatic in the male, not only carry blood to the uterus, but also to the ovaries and to the oviducts. In addition to the arteries mentioned, a branch from the epigastric, on each side, passes through the round ligament to the uterus. On account of the number and volume of the arterial currents supplying the uterus, this organ has been compared to the brain. The uterine arteries are given off by the internal iliacs, while the ovarian proceed directly from the aorta just below the renal. The uterine artery, pursuing a remarkably flexuous course, enters the base of the broad ligament, and at the middle of the cervix gives off two branches, one of which passes in front of, the other behind the cervix, to unite with corresponding branches derived from the other uterine artery, thus making a complete anastomosis, and at the same time forming an arterial ring which encircles this portion

[1] De Sinéty. [2] Schwartz.

of the uterus. The chief trunk ascends, and at the level of the fundus gives off a large number of branches, which enter beneath the peritoneum into the muscular tissue to pass to the mucous layer, becoming capillaries

FIG. 38.

THE OVARIAN, UTERINE, AND VAGINAL ARTERIES. (HYRTL.)

a. Ovarian artery. *a'* and *b'*. Branches to tube. *b*. Branch to round ligament. *c*. Uterine artery. *c'*. Branches to ovary. *g*. Vaginal artery. *h*. Azygos artery of vagina.

in the muscles, and forming a fine network around the glandular culs-de-sac. The uterine artery anastomoses with the ovarian, forming a large arch. The ovarian is chiefly distributed to the fundus and the

upper part of the body of the uterus. Both the uterine and the ovarian arteries are remarkable for their serpentine course or corkscrew form.

Uterine veins, which anastomose with each other, collect the blood from mucous and muscular capillaries. They are generally large, but in pregnancy so increased in size that they are called sinuses; their walls are firmly fastened to the muscular framework of the uterus by strong connective tissue, and thus "thousands of living ligatures" are provided for the arrest of hemorrhage after detachment of the placenta; the construction of the middle muscular coat of the uterus, with relation of the veins which traverse it, seems to have been especially designed for this purpose. Emerging from the uterus at its sides, the veins freely anastomose so that a large plexus is formed on each side, enclosed in the folds of the broad ligament, known as the utero-ovarian plexus; this plexus is dilated in menstruation and in all other conditions of uterine congestion. Four veins—two uterine and two ovarian—carry the blood from these plexuses; the uterine empty into the internal iliac veins, the left ovarian into the left renal, and the right ovarian directly into the vena cava. Veins also pass through the round ligaments and empty into the epigastrics or into the external iliacs.

The erectility of the uterus is claimed to result from the disposition of its arteries and veins. Rouget showed that when its veins were injected it became erect, swollen, its size greater, and its cavity increased by the separation of its walls. This erection is by some supposed to occur during coition, and to facilitate the entrance of spermatozoids into the uterine cavity.

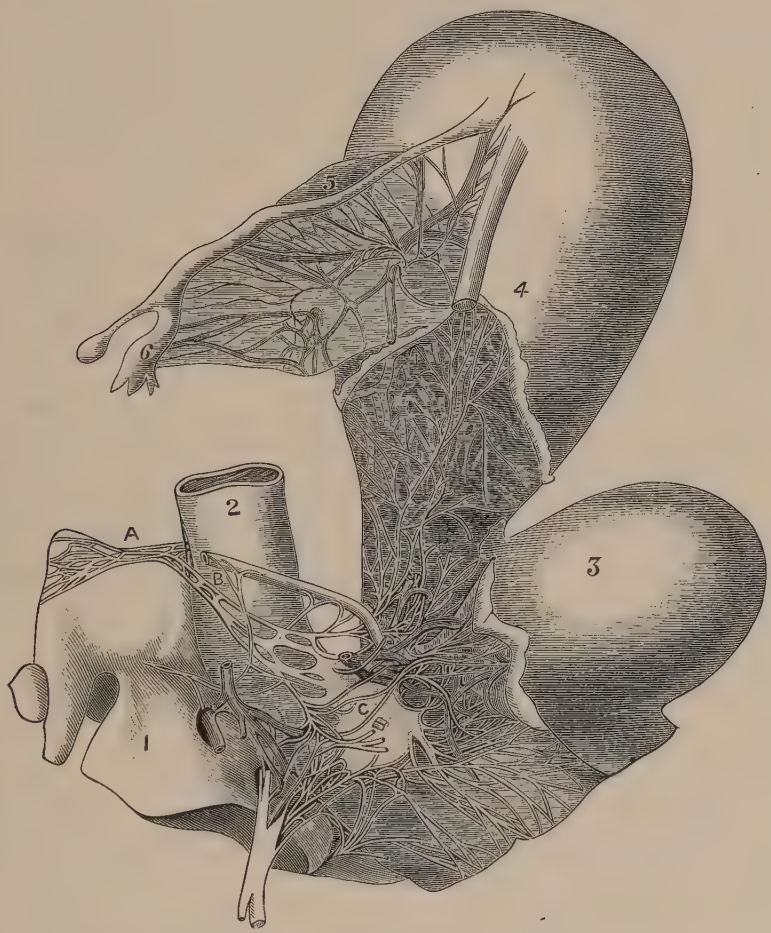
The Lymphatics of the Uterus. These have been divided into three sets or systems, viz.: a subserous, a muscular, and a mucous. The last has no vessels, but is composed of numerous and large lymph spaces, so that the mucous membrane has been called an enormous lymph gland; these spaces freely communicate with each other; they are formed by trabeculæ lined with endolitheum, and encircle the vessels and glandular culs-de-sac; they communicate with the lymphatic vessels of the muscular wall.

The lymphatic system of the muscular coat is arranged in three planes —internal, middle, and external. The first is composed of cylindrical vessels running transversely, placed between the muscular fasciculi, and uniting the submucous lymph set with the middle muscular plane. The second plane is composed of vessels provided with valves, and which are tortuous; these convey the lymph to the vessels of the broad ligaments. The third, or superficial muscular plane, consists of vessels placed longitudinally between the muscular fasciculi; they furnish communication between the large trunks of the middle layer and the subperitoneal lymphatics. The subperitoneal lymphatics are found upon the anterior and upon the posterior face of the uterus, and at its sides. Those of the neck form a large subperitoneal plexus, and then unite in vessels which communicate with the lateral and sacral ganglia. According to Championnière, a ganglion is found on each side of the uterus at the isthmus, and this fact is regarded as of importance in connection with the development of certain puerperal diseases. The subperitoneal

lymphatics of the body of the uterus are large vessels provided with valves; those at the sides directly enter the lymphatic vessels of the broad ligaments, and those upon the anterior and posterior face indirectly through the vessels of the middle muscular plane.

THE NERVES OF THE UTERUS. The *plexus uterinus magnus*, formed by branches from the superior mesenteric plexus and from

FIG. 39.



THE NERVES OF THE UTERUS. (FRANKENHÄUSER.)

A. Plexus uterinus magnus. B. Plexus hypogastricus. 1. Sacrum. 2. Rectum. 3. Bladder. 4. Uterus. 5. Ovary. 6. Fimbriated extremity of tube.

the ovarian ganglia, which receive large branches on both sides from the fourth sympathetic ganglion, is situated at the bifurcation of the abdominal aorta. An inch and a half, 3.79 centimetres, below the bifurcation, directly at the promontory, this plexus divides into two branches which pass right and left about the rectum, and go to the

upper part of the vagina and the uterus; these two branches are the hypogastric plexus. They receive numerous filaments from the fifth lumbar ganglion, and from the first, second, and third sacral ganglia of the sympathetic. When they have reached the side of the rectum the hypogastric nerves divide into two unequal branches. The smaller of these remains at the inner side of the pelvic vessels and is distributed to the posterior and lateral parts of the uterus. The larger branch goes under the vessels, and passes partly to the large cervical ganglion and in part unites with the sacral nerves. The cervical ganglion in pregnancy is nearly two inches long, 5 centimetres, and an inch and a half broad, 3.79 centimetres; it is situated at the side of the posterior vaginal vault, and is formed from both hypogastric plexuses, from the first three sacral ganglia, and from the second, third, and fourth sacral nerves. It supplies the entire uterus, and especially the cervix, with nerves.

The mode of termination of the nerve fibres in the mucous membrane is unknown; in the muscular tissue this termination is, according to Frankenhäuser, in the nuclei of the muscle cells. No ganglia are found in the intra-muscular nerve plexuses of the uterus, and in this regard there is a remarkable contrast between these plexuses and those of the stomach and intestines, which are very rich in ganglia. Physiological experiment has proved the presence of vaso-dilating and vaso-constricting nerves in the uterus.[1] Kleinwächter remarks that a knowledge of the nerve distribution does not explain the way by which uterine contractions are produced.

Spiegelberg has stated that while a motor-centre for the uterus is found in the medulla oblongata, this centre is not the only one which controls the action of the uterus, and at most is a reflex one, and that there are independent centres for uterine contractions in the lumbar spinal cord; but he also stated that there are facts which show that the uterus is, to a certain extent, independent of the spinal centres. Dembo[2] observes there is not a point in the cerebro-spinal system where a centre presiding over uterine contractions was not supposed to be found. According to some, the centre was in the cerebellum; according to others, in the bulb; and still others have found it in both; some place it in the lumbar region of the spinal cord, others at the tenth dorsal vertebra, and others make all points of the spinal cord capable of causing uterine contractions. Some have placed the centre in the great sympathetic, though differing as to the part. Finally, some hold that the uterus has its own independent centres. Among recent investigations are those made by the author just quoted, and his conclusion is that most probably the centres governing uterine contractions are situated beneath the peritoneum, above the anterior wall of the vagina; he has found there numerous ganglionic groups of differeut sizes, some of them with a hundred cells or more.

Position of the Uterus and Means by which the Organ is Sustained. The general place in the pelvic cavity which the uterus occupies, and the relations of the latter to the bladder and the rectum, have been mentioned on page 58. The situation of the uterus is not a

[1] Müller, Handbuch der Geburtshülfe, refers to a case reported by Nasse, in which a primipara suffered with fracture of the third and fourth cervical vertebræ resulting in complete paralysis and anæsthesia, yet normal uterine contractions effected delivery, and to that of Abeille, whose patient had degeneration of the lumbar spinal cord, the labor similarly ending spontaneously, as making questionable the statement that a regulator, or inhibitory centre for uterine action, is found in the lumbar portion of the cord.

[2] Annales de Gynécologie, Feb. 1883.

fixed one, but there is a great normal mobility provided for, so that the organ may change its position according to certain physiological functions, and according to the condition of the neighboring organs. Thus during respiration there are alternate descent and ascent of the uterus; the position varies as to the state of the rectum and of the bladder; it is not the same when the subject is standing or lying down; it varies in the nulliparous and parous, and when at rest, or in the exercise of its physiological functions. The most remarkable change of position from a physiological cause is that which occurs in pregnancy, when from having been a pelvic the uterus becomes almost entirely an abdominal organ; yet after pregnancy is over, and involution completed, it occupies nearly its original position.

FIG. 40.

NORMAL SITUATION OF THE VIRGIN UTERUS WHEN THE BLADDER IS EMPTY.

FIG. 41.

POSITION OF UTERUS IN A WOMAN WHO HAS BORNE A CHILD.

Figs. 40 and 41, from Schultze, show the position of the uterus in the virgin, and in the childbearing woman, when the bladder is empty.

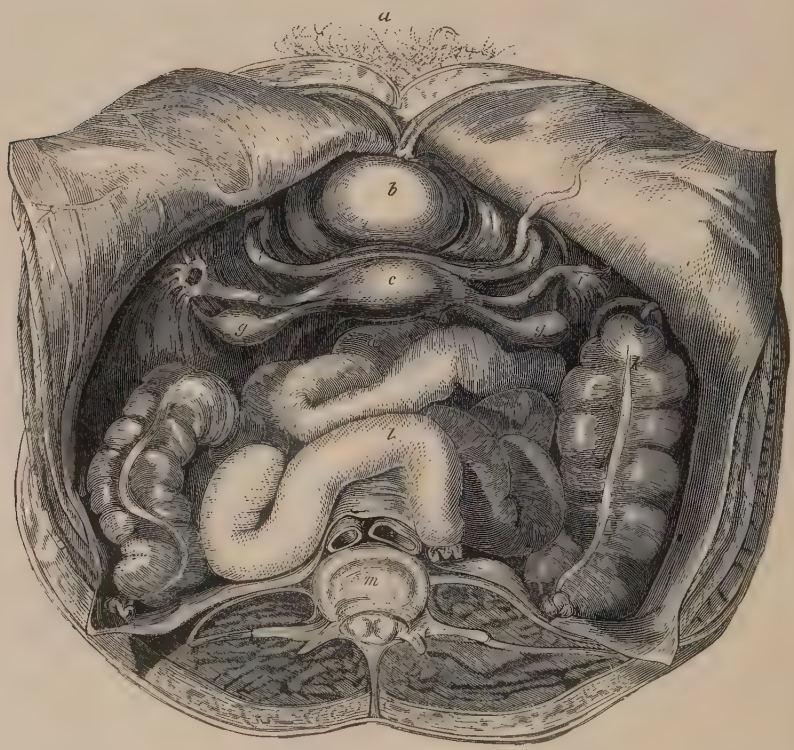
In most instances the uterus is not exactly in the transverse diameter of the pelvis, but a slight rotation occurs by which the left side is thrown toward the front and the right backward. This rotation, which becomes very marked in most women during pregnancy, is simply the expression of an embryonic condition that will be referred to hereafter.

Fig. 42, from Ramsbotham, shows the position and relations of the uterus as seen from above. The uterus is kept in its normal position

by its connection with the vagina, with the bladder, and with the pelvic fascia, and by certain ligaments which will now be described.

The Uterine Ligaments. These are six in number, three belonging to each half of the uterus as made by the antero-posterior division. They are known as the round, the broad, and the utero-sacral, and each is formed by a fold of peritoneum including between the two sides muscular and connective tissue, vessels, and nerves.

Fig. 42.



Uterus with adjacent Organs, as seen from above.

a. Mons veneris. *b*. Bladder. *c*. Fundus of the uterus. *d*. The rectum. *e*, *e*. The oviducts. *g*, *g*. The ovaries. *h*, *h*. Posterior processes of broad ligaments. *i*, *i*. Round ligaments. *k*. Cæcum with its appendages. *l*. Small intestine. *m*. Body of one of the lumbar vertebræ.

The Round Ligaments. The round ligaments are two cords covered by peritoneum, passing from the uterus at a point a little below the origin of the oviducts, and at the junction of the anterior face with the lateral border of the uterus to the inguinal canal, where their peritoneal investment ceases, and they somewhat change their form; each ligament is continued through the inguinal canal, and ends by an expansion of its fibres in the upper part of the labium majus, also to mons veneris. The ligament has not only unstriped, but also striped, muscular fibres; the latter originate from the lower part of the inguinal canal and from the pubic spine, and are continued toward the uterus,

but end at the level of the pelvic inlet. The round ligament has a notable amount of connective and elastic tissue, and contains an artery, which, originating from the epigastric, passes on toward the uterus and anastomoses with the uterine artery, thus making a connection between the general circulation and that of the uterus. Up to the eighth month of fœtal life the peritoneum is continued into the inguinal canal, making the canal of Nuck, when it is usually closed; should it remain open, an effusion into this peritoneal prolongation may occur, and the disease is known as hydrocele of the female. In the non-pregnant condition the round ligaments play an important part in preventing retroversion or retroflexion of the uterus. During pregnancy they are remarkably increased in size, but unequally, and it has recently been stated[1] that by examining them through the abdominal wall, and appreciating their development, a correct prognosis can be given as to the activity of the labor-pains, for that development is a guide to the muscular development of the uterus. During labor the contraction of the round ligament draws the upper part of the uterus forward, securing economy of force by the direction given it during uterine contractions.

The Broad Ligaments. These extend from the sides of the uterus to the sacro-iliac joints. They are separated from each other by the intervening uterus, but the anterior layer of the one side is continuous with that of the other, passing over the anterior face of the uterus; in like manner the posterior layers are continuous. Thus the pelvic cavity, by means of these ligaments and the uterus, is divided transversely into two unequal parts, the anterior being known as the vesical, the posterior as the rectal. The superior border of the broad ligament presents three peritoneal folds, known as wings—an anterior, a middle, and a posterior wing; the first includes the round ligament, the second the oviduct, and the third the ovarian ligament, which is attached to the inferior border of the ovary. At the sides of the pelvis the peritoneal layers of the broad ligament separate, being continuous with that lining the pelvis; below a separation also occurs, the posterior fold to be reflected over the rectum, the anterior over the bladder. At the internal border of the ligament the two peritoneal folds separate to receive the uterus. Large veins and lymphatics pass from the uterus at this border. The broad ligaments contain between the peritoneal folds connective tissue, vessels and nerves, and muscular fibres; the adherence of the serous membrane to the muscular tissue of the uterus is so intimate that the former cannot be separated without at the same time removing part of the muscular layer.

The broad ligaments, beside assisting in the suspension of the uterus, prevent its lateral deviation, and aid in restoring it to its normal position after partial retroversion caused by a distended bladder. During pregnancy the peritoneal folds separate so completely to accommodate the enlarging uterus that at the end of gestation the broad ligaments have almost completely disappeared.

The Parovarium, or Body of Rosenmüller. If that portion of the recently removed broad ligament, including the oviduct and the

[1] Bomburger: Gynäkologische Klinik herausgegeben von Dr. Wilhelm Alexander Freund. Erster Band. 1885.

ovary, be held up to the light, there will be seen a series of fine tubes passing to the hilum of the ovary, and each terminating in a cul-de-sac; above these, tubules communicate with a canal perpendicular to them and parallel to the oviduct. The number of tubes is said to be from fifteen to eighteen, but Doran[1] mentions finding in one specimen twenty-four. The organ thus described is called the parovarium, or body of Rosenmüller; it is the vestige of an embryonic structure known as the body of Wolff. The efferent duct continues patent in some of the domestic animals, and is called the canal of Gartner. The two urethral ducts described by Skene have been by some thought to be the inferior portion of the efferent ducts of the parovarium; the development of one form of vaginal cyst from Gartner's canal is less doubtful.

The Utero-sacral Ligaments. These are two semi-lunar folds passing from the uterus posteriorly just above the union of the vagina, and attached to the third and fourth sacral vertebræ immediately within the lower part of the sacro-iliac joint. They form by their superior lateral borders a narrowed passage, or mouth of Douglas's cul-de-sac, or the retro-uterine peritoneal pouch, and in some cases, where the retroverted uterus has sunk into this pouch, may hinder its restoration. These ligaments contain muscular tissue, and are hypertrophied in pregnancy. According to Luschka, a part of the muscular fibres of each side unite behind the cervix, making a half-ring, and the muscle formed by this union is called the muscle of Luschka, or, with reference to the function assigned it by him, the retractor of the uterus. Schultze regards it as the elevator rather than the retractor of the uterus, while the general action of the folds is that of a suspensory ligament of the uterus.

The utero-sacral ligaments are elongated in pregnancy. Vesico-uterine ligaments are also described by some; however, little importance is attached to them as means for keeping the uterus in normal position.

The Ovaries. These organs, of equal importance with the testicles of the male for reproduction, were called by Galen *testes muliebres*. They are sometimes classed as glandular organs, their supposed function being to secrete ovules; but as the ovule has to a certain degree its existence before the ovary, the latter serves as a place of deposit, of preservation and completion for the primordial ovules, and does not secrete, but contributes to the evolution of these essential anatomical elements of the organ, and for which it is made.

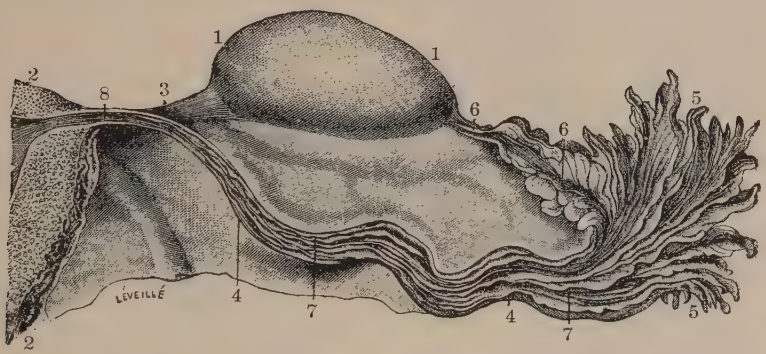
Number, Position, and Attachments of the Ovaries. The ovaries in the human female, as in almost all vertebrates, are two; in birds,[2] however, but a single ovary, usually the left, is found, the other having atrophied, this atrophy beginning about the seventh day of incubation. These organs are in the pelvic cavity, one on each side of the uterus; their long diameter[3] is not transverse, as is usually represented, but parallel to the lateral pelvic walls, and almost at the level of the plane of the inlet; their attachment to the pelvis is higher than that to the uterus; their superior border is at the plane of the inlet, and

[1] Tumors of the Ovaries, etc
[2] Duval.
[3] Schultze.

below the internal border of the psoas and iliac muscles. According to Schultze, the contraction of the belly of the combined psoas and iliacus muscles is the best guide for the external hand in bimanual palpation of the ovaries; and Charcot states that the ovarian pain of the hysterical corresponds most frequently with the point of intersection of two lines, the one drawn between the superior anterior iliac spines, and the other marking the prolonged lateral boundary of the epigastrium.

The ovaries are placed in the posterior wing of the broad ligaments; they are behind the oviducts and in front of the rectum, being usually separated from the latter by coils of intestine. By their relation with the broad ligaments they are connected externally with the pelvic walls. Other attachments are by the utero-ovarian, the tubo-ovarian, and the posterior round ligaments. The utero-ovarian ligament, by some called the ovarian ligament, is a cord composed of smooth muscular fibres; these fibres may be followed into the posterior wall of the uterus, and traced down as far as the internal os; it passes from the superior angle

FIG. 43.



THE OVARY AND OVIDUCT. (The latter opened longitudinally.)

1, 1. Ovary. 2. Part of the uterus. 3. Ovarian ligament. 4, 4. Oviduct, its walls opened by a longitudinal incision to show the longitudinal folds of its lining membrane. 5, 5. Pavilion from internal surface. 6, 6. Fimbria attached to the ovary, or tubo-ovarian ligament. 7, 7. Longitudinal folds. 8. Internal end of the oviduct.

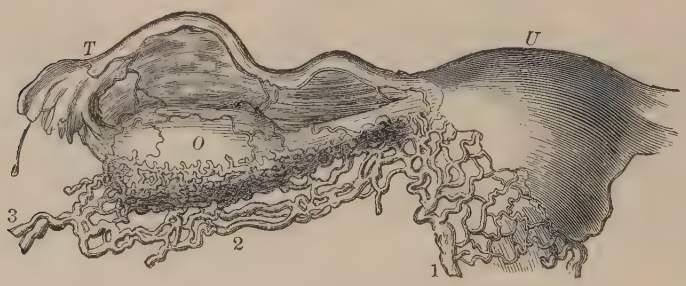
of the uterus on each side to the internal end of the ovary. This ligament is about one inch and a quarter, 3.16 centimetres, in length. That portion of the broad ligament not occupied by the oviduct connects the ovary with the pelvic brim, and is known as the infundibulopelvic ligament. The ovary is thus suspended by and between this ligament and the ovarian; but the pelvic attachment is higher than the uterine, and hence the long diameter of the ovary is not horizontal, but parallel to the lateral pelvic wall, according to the statement of Schultze; he asserts that the long axis of the ovary is nearly vertical, a view which is confirmed by Hart and Barbour. The tubo-ovarian ligament is formed by the attachment of one of the fringed processes of the pavilion of the oviduct to the external end of the ovary. It is probable that the superior surface of this ligament bears an important part in the transfer of the ovule from the ovary to the oviduct.

The middle fibres of the posterior round or lumbar ligament pass to the ovary. This ligament, according to Rouget, is formed of a lamella of smooth muscular fibres which originate from the sub-peritoneal fascia, passing from behind forward to be distributed, the internal upon the body of the uterus, the external to the pavilion, and the middle to the hilum of the ovary.

The ovary has considerable mobility, and hence the possibility of both physiological and pathological changes of position, the most remarkable of the former being that which occurs in pregnancy, for the ovaries ascend with the uterus into the abdominal cavity, and afterward descend with it into the pelvis.

Form, Size, and Aspect of the Ovaries. The ovary is usually an ovoid, somewhat flattened antero-posteriorly; its superior border is convex, and its inferior plane; its ends, or extremities, give attachment to the ligaments already mentioned. Except these attachments, and that of the inferior border to the peritoneum, the organ is free. The size of the ovaries varies in individuals at different ages and as to the condition of ovulation; it is greater during menstruation and during pregnancy than at other times; the right ovary is usually somewhat larger

Fig. 44.



Bulb of Ovary.

than the left. The average dimensions of the organ are, in length 1.4 inches, 38 millimetres; in vertical measurement 0.7 of an inch, 18 millimetres, and antero-posteriorly half an inch, or 15 millimetres. The weight of the ovary is from 90 to 120 grains, or 6 to 8 grammes. Doran[1] states that the average weight of the normal ovary is at least 100 grains; its long axis is a little over two inches, its short axis one inch, its thickness quite half an inch. The surface of the ovary is white and smooth at the beginning of menstrual life; it becomes uneven and irregular from the cicatrices of ruptured ovisacs, these being more numerous as age advances, and the color changes to a yellowish-brown.

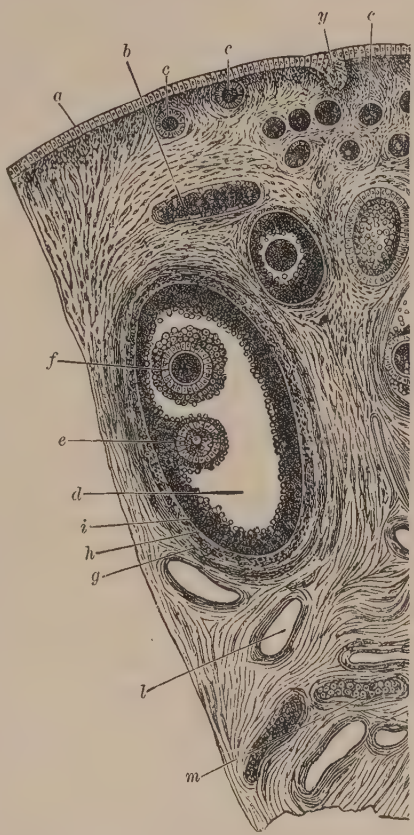
The Hilum and Bulb of the Ovary. Between the two layers of peritoneum which are attached to the inferior border of the ovary, the ovarian vessels and nerves pass. The arteries, eight or ten in number, derived from the anastomosing arch of the uterine and ovarian, have a helicine form before entering the hilum of the ovary; upon this

[1] Handbook of Gynecological Operations. Blakiston, Son & Co., Philadelphia, 1887.

layer of arterial vessels there is placed, in front and behind, a much thicker layer of venous vessels; an injected specimen shows a large mass of bloodvessels, chiefly venous, which communicate with the pampiniform plexus and with the uterine plexus. This is the bulb or spongy body of the ovary; it should not be confounded with the bulbous portion of the ovary, which will hereafter be described

STRUCTURE OF THE OVARY. It was once generally held that the ovary was covered by peritoneum, and had a tunica albuginea, but neither statement is now regarded as true. The researches of Waldeyer have shown that the peritoneum ceases at the inferior border of the organ, and that all the rest of its surface is covered with a simple layer of flattened cylindrical epithelium; this covering presents a dull-white appearance, which is in striking contrast with the bright, almost shining, appearance of the peritoneum; at the inferior border of the ovary there can be seen a finely notched line, marking the place where the latter ceases and the former begins. The supposed tunica albuginea has been proved to be, instead of a mere covering, the essential part of the organ. A vertical section of the ovary shows that it is composed of two very different substances. The superficial or cortical portion is white, firm, and apparently homogeneous; the internal or medullary portion is reddish, spongy, and not homogeneous; it constitutes seven-eighths of the organ. The ovisacs are found only in the superficial layer, and it is therefore called by Sappey the glandular or ovigenous portion; while the central part, the great mass of the organ, is called the bulbous portion; by some it is also called the medullary portion.

FIG. 45.



FROM AN OVARIUM OF AN OLD BITCH. High power. (STRICKER.)

a. Germinal epithelium. *b*. Ovarian tubes. *c*. Younger follicles. *d*. Older follicles. *e*. Proligerous disk, with egg. *f*. Epithelium of second egg in the same follicle. *g*. Tunica fibrosa folliculi. *h*. Tunica propria folliculi. *i*, Epithelium of the follicle (membrana granulosa). *l*. Vessels. *m*. Cell tubes of the parovarium in long section. *y*. Tubiform depression of the germinal epithelium into the ovarian tissue.

The peripheral or ovigenous layer is the essential part of the ovary; it is composed of an external layer of epithelium, representing the

germinative epithelium of the pleuro-peritoneal cavity of embryonic life; of a fibrous framework, the fibres crossing each other, the superficial portion more dense than that beneath it, yet no line of separation between the two; in the meshes of this tissue the ovisacs are found. Only fifteen or twenty ovisacs can be discovered by the unaided eye, but the microscope reveals an almost infinite number. Sappey's investigations have authorized him to state that in each ovary of a girl eighteen or twenty years of age there are more than three hundred thousand, making some seven hundred thousand for the two; in one instance, that of a girl four years old, the number was one million one hundred and fifty thousand. Nature is prodigal in supplying means for the continuance of the race. The bulbous portion is composed of vessels, nerves, muscular and connective-tissue fibres; it furnishes nutritive material to the ovisacs and ovules, and also a surface upon which the ovisacs may be distributed, so as to facilitate their growth and rupture and the reception of the escaping ovules by the oviduct.

Vessels and Nerves of the Ovaries. The arterial supply of the organ, as well as the helicine course of the arteries before entering the hilum, has been mentioned. These vessels after penetrating the ovary still preserve the helicine form; they are distributed to the bulbous portion, and fine ramifications pass to the ovigenous layer, but scarcely reach the most external part; vessels, however, pass to the walls of ovisacs that have attained notable development. The veins are remarkable for their size, varicose appearance, and numerous anastomoses; after contributing to the formation of the bulb of the ovary, the blood passes from the bulb on either side into the ovarian veins. The nerves are from the ovarian plexus. Their final distribution is not known; Duval suggests that they are especially designed for the vessels and the unstriped muscular tissue of the bulbous portion; Luschka has seen an axis-cylinder enter the wall of an ovisac. Large lymphatic vessels emerge at the hilum and pass to the lumbar ganglia. It has been shown that the tissue about an ovisac is rich in lymph-supply, so that, as de Sinéty remarks, the follicle is plunged into a closed lymph sac, a condition which appears very favorable for nutrition.

The Ovisacs. These were discovered by de Graaf, in 1672, and are frequently called the Graafian vesicles or follicles; but a designation which points to their most important office, containers of ova, and therefore ovisacs, seems more appropriate.

An ovisac consists of a capsule, and within the capsule the membrana granulosa, the liquid of the ovisac, and the ovum. The capsule is described by some as composed of two layers, an external called the tunica fibrosa, and an internal called the tunica propria. But as it is impossible to separate the supposed external one from the surrounding ovarian tissue, "from which it does not differ except from its fibres being looser, and the greater predominance of cell elements," most authorities consider the capsule as having but a single wall. This is a thin, transparent, vascular membrane, composed, according to Robin, of fibrous laminæ pressed against each other, transparent amorphous matter with fine granulations, and large polyhedric cells with rounded angles, which are not found elsewhere, except in the uterine mucous

membrane developed by pregnancy. The liquid of the ovisac, liquor folliculi, is clear, viscid, alkaline, and contains oil globules and granulations.

Upon the inner surface of the capsule a layer of round nucleated cells is found, constituting the membrana granulosa. An accumulation of these cells occurs at some part of the ovisac, forming the discus proligerus, and in this mass the ovum is found. The discus proligerus is not usually at the most projecting part of the ovisac, but at its lowest. The ovum, or ovule, discovered in 1827, is spherical, and about $\frac{1}{120}$ of an inch in diameter. It is composed of three parts, an investing membrane, the vitelline membrane, a granular liquid, known as the vitellus, a transparent vesicle, the germinal vesicle, and, finally, the germinal spot. The germinal vesicle, or nucleus of the ovule, is $\frac{1}{700}$ of an inch in diameter, and the germinal spot, or nucleolus, is $\frac{1}{3000}$ of an inch in diameter.

THE OVIDUCTS.[1] These are canals or tubes, placed one on each side of the uterus, through which the spermatozoids pass to or near to the ovaries, and by which the ovule is transmitted to the uterus. In relation to the ovaries, they are its excretory ducts. They are in the upper border of the middle fold of the broad ligaments. An oviduct is between four and five inches, ten to twelve centimetres, long; its diameter increases from the uterus to the ovary; this is, according to Sappey, near the uterus, 0.15 of an inch, or four millimetres; at its middle portion, 0.19 to 0.22 of an inch, or five to six millimetres; and at the abdominal opening, 0.27 to 0.31 of an inch, or seven to eight millimetres. At the abdominal end there is an expanded portion, having a diameter of about seven-tenths to eight-tenths of an inch, 18 to 20 millimetres, called the pavilion or ampulla. The external surface of the pavilion is covered by peritoneum continuous with that of the body of the oviduct; its internal surface is concave, and lined with ciliated mucous membrane; its margin, where continuous with that lining the oviduct, meets serous tissue, is not uniform and regular, but divided by numerous fissures, so that it presents a fringed appearance, and the projections thus formed are called fimbriæ. Some of the fimbriæ are rounded at their free end, others elongated and irregular; one of them is without free extremity, but is attached to the ovary, making the tubo-ovarian ligament; and hence the pavilion necessarily follows the ovary in its physiological or pathological changes of position; the tubo-ovarian ligament presents upon its upper surface a groove or canal leading directly to the oviduct. The number and delicacy of the fimbriæ can be well seen by taking a fresh specimen of the oviduct and gently moving the abdominal end to and fro in clear water. From the opening into the oviduct a number of folds, continuous with similar formations in the body of the organ, radiate to the circumference of the pavilion.

An accessory pavilion is found, according to Sappey, once in sixty

[1] Commonly called Fallopian tubes. Fallopius, a famous anatomist of the sixteenth century the successor of Vesalius in the University of Padua, describing the oviduct compared it to *tuba*, a trumpet, not a tube or canal; and his name has been given to the organ. But the oviducts were described long before the time of Vesalius by Erophilus, and then by Rufus of Ephesus. It seems, therefore, that it would be better to have the names of these organs determined by their most important function, that of excretory ducts for the ovaries, than to perpetuate one which is doubly misleading.

subjects; once in sixteen, according to Richard. In some instances two have been observed, and once three. They have the same form as the normal one, and communicate with the oviduct; it is possible that the ovule may enter one of these from the oviduct, and thence pass into the abdominal cavity. The internal or uterine orifice of the oviduct is only one-twenty-sixth of an inch, or one millimetre, in diameter. The oviduct is formed of three coats, an external peritoneal, a middle muscular, and an internal mucous. The peritoneal coat extends from the uterus over the entire length of the organ, but of course fails at the lower portion corresponding with the interval between the folds of the broad ligament. The muscular coat consists of a layer of longitudinal fibres, and beneath it one of circular fibres; both of these are continued into the muscular walls of the uterus. The mucous membrane is thrown in folds which are closely applied to each other, so that there may result a capillary attraction, similar to that observed when two pieces of glass are pressed together, and then partly immersed in water. The mucous membrane is lined with ciliated epithelium, the movement of the cilia being from the ovary to the uterus; this condition is supposed to be a factor in the transmission of the ovule to the uterus.

FIG. 46.

SECTION OF NORMAL FALLOPIAN TUBE. (After BLAND SUTTON.)

J. Bland Sutton[1] has recently shown that the mucous membrane of the oviducts is glandular; these glands are formed by infoldings of the surface epithelium, and hence are very simple in character. In oviparous vertebrates the glands of the oviduct secrete a viscid albumin for the investment of the ovum. Sutton adds: "So far as the human ovum is concerned, there is little room to doubt that the viscid albuminous material secreted by the glands of the Fallopian tube serves as a pabulum for the embryo in its early stages, absorption taking place by means of the chorionic villi, which, standing upon the zona pellucida, are immersed in a highly nutritive bath furnished by these glands."

The oviducts have the same source of blood and nerve supply as the ovaries. The lymphatics unite with those of the uterus and of the ovary.

DEVELOPMENT AND SOME OF THE ANOMALIES OF THE FEMALE GENERATIVE ORGANS. While naturally belonging to the subject of Embryology, it is thought suitable to give in connection with the anatomy of the female organs of generation a brief sketch of their development, and present some of the anomalies of obstetric interest and importance that may occur in that development.

DEVELOPMENT OF THE EXTERNAL ORGANS OF GENERATION. The formation of these organs begins in the fourth week of embryonic

[1] London Obstetrical Society's Transactions, vol. xxx. London, 1889.

life. At that time[1] there is at the posterior extremity of the body a simple opening, representing the orifice common to the intestine and the allantois, the future bladder, into which the Wolffian canals will also empty, and which is the orifice of the cloaca—the inferior portion of the intestine after the development of the allantois being called the cloaca. Before this single opening is divided into two, anal and uro-genital, there appears in front of the orifice an elevation called the genital swelling or tubercle; then two lateral folds, the genital folds. At the end of the second month this swelling is greater, and there is seen at its lower part a cleft or fissure, extending to the opening of the cloaca, the genital furrow. About the middle of the third month the cloacal opening is divided so as to form two orifices; the most generally received explanation of this division is that it occurs by the formation of two lateral folds from the cloaca, and at the same time a projection from the point of union of the rectum and allantois descends; the lateral folds and the central process unite so as to form a complete wall, the inferior border of which becomes the perineum, and the wall divides the cloaca into two cavities, rectal and uro-genital.

The labia majora are developed from the lateral genital folds, and the labia minora from the borders of the genital fissure, while the clitoris is formed from the genital tubercle, or the upper part of the genital swelling. Into the uro-genital sinus the bladder developed from the allantois and the seminal ducts empty, and hence its name. This sinus is shortened by the descent of the vagina, and in the fourth month of embryonic life the urethra and vagina are distinct canals.

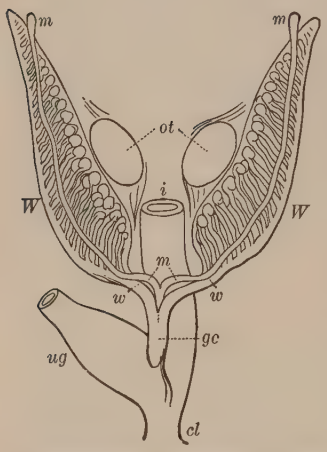
Development of the Internal Organs of Generation. The internal genital, as well as the urinary, apparatus is developed from two transitory embryonic structures known as the Wolffian bodies. From the fact that these bodies temporarily exercise the function of the kidneys they are known as primitive kidneys, false kidneys, primordial kidneys, and kidneys of Oken. Their structure is analogous to that of the kidneys: they are composed of an excretory duct, which occupies a longitudinal position, and of fine tubes which are transverse and empty into this duct; these canaliculi are enlarged at their closed end, and in this enlargement a vascular glomerulus is found. The duct appears prior to the gland, according to the general law[2] in the formation of all glandular organs, that the excretory canal is first formed. In the second month of embryonic life the Wolffian body appears as an oblong mass situated on the side of the vertebral column, and extending from the chest to the pelvis. These bodies soon become atrophied, leaving as their chief vestige on each side the organ of Rosenmüller, or the parovarium, which has been described in connection with the description of the broad ligaments. Before this atrophy occurs there is a notable thickening of epithelium, called by Waldeyer germinative epithelium, composed of long cylindrical cells upon the inner and upon the outer surface of the Wolffian body; the former is the origin of Müller's duct, the latter of the ovary and the ovules. The formation of Müller's duct takes place, according to Waldeyer, by the appearance of a

[1] Kölliker.

[2] Imbert, op. cit.

longitudinal fold of the germinative epithelium which is sunk in the connective tissue of the external lateral part of the Wolffian body; this fold is covered over and thus converted into a tube. It remains open externally, and that portion becomes the pavilion. The occurrence of secondary pavilions, to be referred to in the description of the oviduct, is readily explained, according to Duval, by supposing that the canal of Müller is not completely closed in all its extent at the period of embryonic life when the two borders of the gutter, which give origin to it, are turned toward each other, in order to transform the gutter into a canal. Müller's ducts unite in a part of their course to form the uterus and the vagina; the limit to this union is the insertion of the round ligament, which is the analogue of the gubernaculum testis in the male, and has the same relations with the inguinal canal. All of the duct below the round ligament unites with the corresponding portion of the duct on the other side, thus making at first a double uterus and vagina; but absorption of the intervening wall occurs, and each organ is single. The left duct is usually further in front than the right, and the two are united in this oblique position; the presence of the intestine upon the left side is thought to explain the fact that the left duct is placed further to the front than the right. The fusion of the two ducts is complete in the embryo of two months. The point at which this union begins is unsettled. Kölliker believes that it is at the middle of Müller's canals, while others hold that it takes place from below upward. All that portion of the duct above the insertion of the round ligament becomes the oviduct. The prominence on the internal face of the Wolffian body is composed of a mass of embryonic connective tissue covered by well-developed germ epithelium; it is the first rudiment of the genital gland, and is found alike in the embryo which is to be a male, as well as in that which is to be a female; in the female the ovaries and ovules are derived from the epithelial covering, while the outgrowth itself is destined to furnish the vascular stroma of the ovary.

FIG. 47.



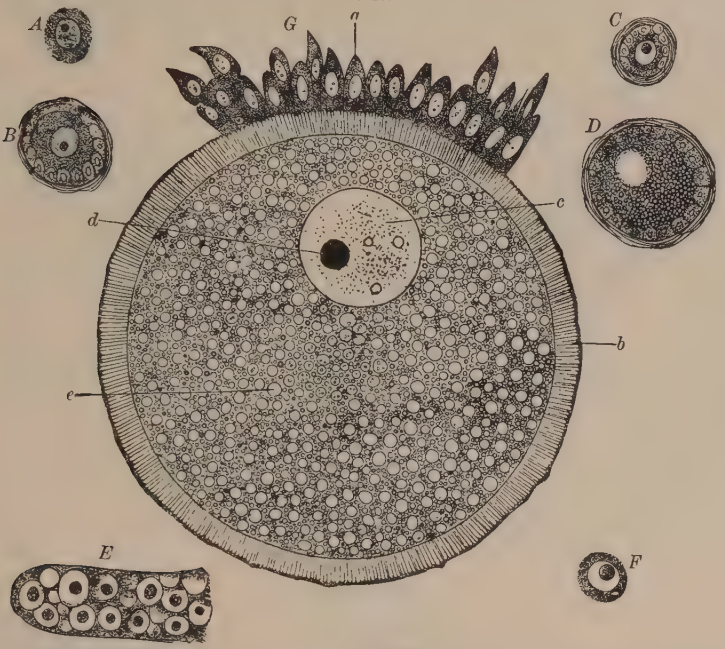
DIAGRAMMATIC OUTLINE OF THE WOLFFIAN BODIES, AND THEIR RELATION TO THE DUCTS OF MÜLLER AND THE REPRODUCTIVE GLANDS. (From ALLEN THOMSON.)

ot. Seat of origin of ovary or testes. *W.* Wolffian body. *w.* Wolffian duct. *m.* Duct of Müller. *gc.* Genital cord. *ug.* Uro-genital sinus. *i.* Rectum. *cl.* Cloaca.

The next change that is observed is the appearance of cells, which are round, have a well-developed nucleus and distinct nucleolus; these are the primordial ovules or primitive ova. At the deep part of the genital eminence, and in close contact with it, sections show that the tubes of the upper portion of the Wolffian body are narrower and have a clearer epithelium than those of the lower portion; the superior is known as the sexual or genital portion, the inferior as the urinary. If

the genital prominence is to be developed into a testicle, the germinative epithelium and the primordial ovules rapidly disappear; but if it is to

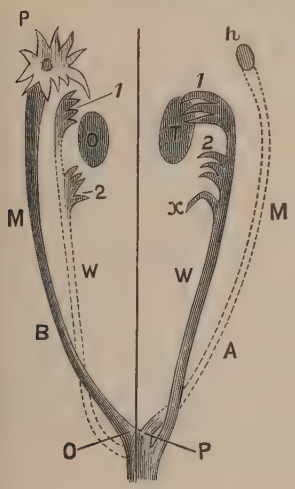
FIG. 48.



HUMAN OVULE, AND OVULES OF RABBIT, PIGEON, AND ASCARIS. (High power.)

A. Primordial egg (human) from a fœtus at the eighth month. *B*. Primordial follicle from a rabbit; *C*, from a pigeon. *D*. A somewhat older follicle from the same animal, exhibiting the commencement of the formation of the secondary yolk. *E*. Cæcal extremity of the ovary of the ascaris nigrovenosa. *F*. An egg of this animal. *G*. An egg from the follicle of a rabbit, 2 mm. in diameter; *a*. epithelium of the ovum; *b*. radially striated zona pellucida; *c*. germinal vesicle; *d*. germinal spot; *e*. yolk.

FIG. 49.



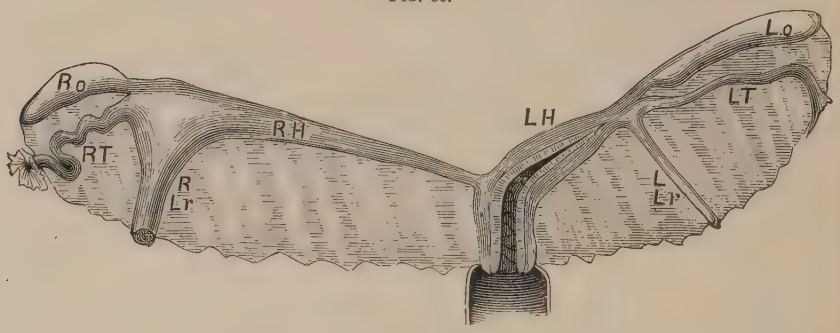
SCHEME OF THE HOMOLOGY OF THE INTERNAL GENITAL ORGANS OF THE MALE (A. RIGHT SIDE) AND OF THE FEMALE (B. LEFT SIDE).

O. Ovary. T. Testicle. W. Canal of Wolff; in the female it atrophies; in the male it forms the deferent canal. The genital part (1) of the Wolffian body is represented in the male by the epididymis, in the female by the body of Rosenmüller. The urinary portion (2) forms in the male the paradidymis, in the female the parovarium; it also forms in the male the vas aberrans (x). M. Canal of Müller; it disappears in the male. Its free extremity, which forms in the female the pavilion (P), forms in the male the hydatid of Morgagni (*h*). Its inferior extremity forms in the female the uterus and the vagina (O) and in the male the prostatic utricle (P).

be an ovary, the former becomes more developed and the ovules increase in number. The primordial ovules, in consequence of the growth of other cells, especially of those of the mesoblast, which furnishes the framework of the ovary, pass from their superficial position into the subjacent layer; in this change of place they carry with them ordinary epithelial cells, and thus each ovule is furnished with an envelope which is lined with epithelium, and so the ovisac or Graafian vesicle is formed. According to Pflüger, however, the changes are as follows: the proliferating germ epithelium sends prolongations into the forming mass of the ovary—inversions of the external covering—and thus tubes full of cells, and which become separated from the surface, result. Constrictions occur in these tubes, and the portion between the two constricted parts, each bead in the strand, represents a Graafian vesicle, the inversions of the external covering, at first tubular, then becoming glandular cords.

Dr. Foulis, from his investigations as to the development and structure of the ovary, denies the presence of tubular structures, and therefore the formation of Graafian vessels as given by Pflüger. His statement is this:[1] All the ova are derived from the germ epithelial cells. In the development of the ovary small and large groups of the germ epithelial cells become gradually imbedded in the ever-advancing stroma. Germ epithelial cells do not grow downward into the substance of the ovary. The ovarian stroma constantly grows outward, surrounding and imbedding certain of the germ epithelial cells. As these latter increase in size, and as the stroma thickens around them, the whole ovary becomes

FIG. 50.



UTERUS UNICORNIS. (From SCHRÖDER.)

LH. Left horn. *LT.* Left tube. *Lo.* Left ovary. *L Lr.* Left round ligament. *RH.* Right horn. *RT.* Right tube. *Ro.* Right ovary. *R Lr.* Right round ligament.

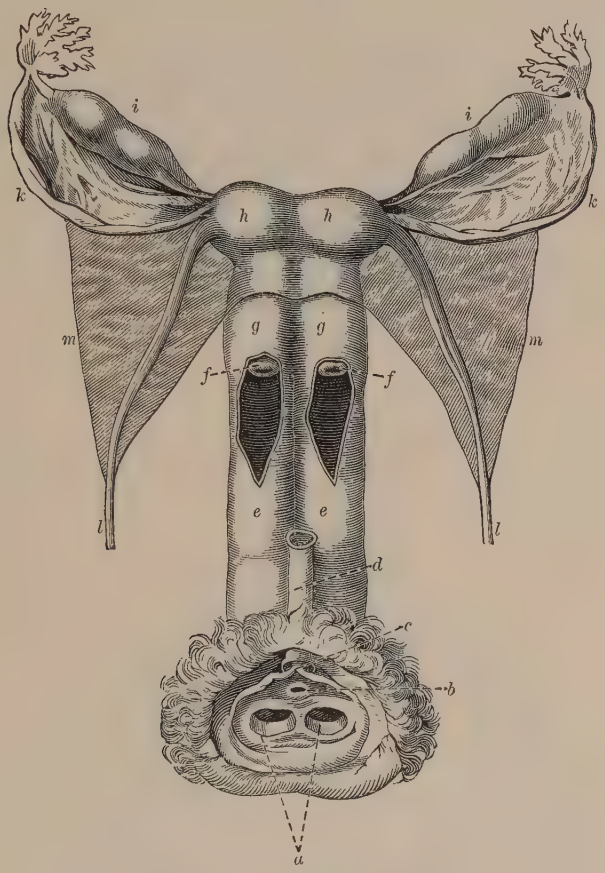
enlarged. Pflüger's tubes in the kitten's ovary have no existence as such, but are appearances produced by long groups of imbedded germ epithelial cells, many of which groups are not completely cut off from the germ epithelial layer by the young ovarian stroma. Such growths of germ epithelial cells, in various forms, are met with in all ovaries, but have no importance whatever as tubular structures. No real tubular structures from which Graafian follicles are formed exist in the mammalian ovary at any stage of its development.

In reference to the general development of the internal generative organs there is in embryonic life a certain period of sexual indifference, a period when the substratum for the evolution of a male or a female

[1] Transactions of the Edinburgh Obstetrical Society, vol. v., 1879.

is alike, and nature gives no indication of her purpose as to which shall be produced. In this connection the homologies between the male and female internal generative organs are of interest; these homologies are well shown in Fig. 49, from Duval.

FIG. 51.



UTERUS BICORNIS DUPLEX. (From KUSSMAUL, after EISENMANN.)

a. Double entrance to vagina. *b*. Meatus urinarius. *c*. Clitoris. *d*. Urethra. *e, e*. Double vagina. *f, f*. External orifices of uterus. *g, g*. Double cervix. *h, h*. Bodies and horns of uterus. *i, i*. Ovaries. *k, k*. Tubes. *l, l*. Round ligaments. *m, m*. Broad ligaments.

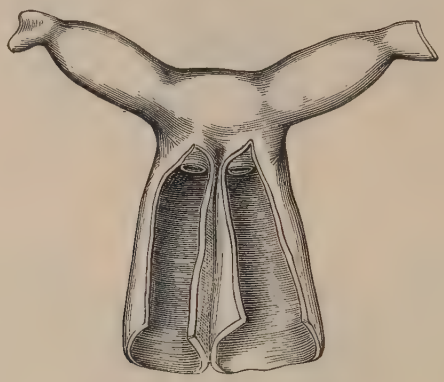
Anomalies of development of the external sexual organs may be the cause of sterility, but chiefly interest the obstetrician in regard to the determination of sex in some cases of miscarriage, or, in other instances, in which labor occurs after the fœtus is viable.

At three months the clitoris is as long as the penis, and indeed from the relatively greater size of the former compared with other organs of the vulva in the early months of intra-uterine life mistakes as to the

[1] Winckel.

sex may arise if a thorough examination be not made. At birth, too, if there be congenital hypertrophy of the clitoris, similar error may occur, and a female be thought a male infant. The difficulty[1] is increased if not only the clitoris but also the labia majora be hypertrophied, for with the hypertrophy of the latter organs they may be united higher than normal, and may contain, as has been observed in some cases, the sexual glands. These anomalies may not only lead to mistakes as to the sex in some cases, but in others to the assertion of hermaphroditism. Such errors were much more frequent in ancient than in modern times, and led to the sacrifice of many newborn, for the supposed union of the sexes in an individual was regarded as so monstrous that the Athenians threw into the sea, the Romans into the Tiber, all infants who were thought hermaphrodites. In most cases of alleged hermaphroditism the condition is *apparent*, not *real*, and arises when the external generative organs of one sex very closely resemble those of the other; it is called female hermaphroditism if this condition is observed in the female.

Fig. 52.



Double Vagina and Uterus.

Anomalies of the uterus and vagina are in most cases plainly caused by arrests of development. Thus in case of duplicity of the vagina the process of development was arrested after the union of that portion of Müller's ducts from which this organ originates, but before absorption of the intervening wall.[1] If the vagina be double, usually the same condition is present in the uterus. In some cases one of Müller's ducts atrophies, but the other is developed, and a one-horned uterus results. Müller's ducts may unite below the insertion of the round ligaments, and the uterus then has two horns. In some cases the fundus of the uterus is not developed, but the surface is depressed, and the organ is said to be heart-shaped, or cordiform. The dividing-wall in the two parts of Müller's ducts may be complete, or the lower part absorbed; in the one case the condition is described as uterus septus, or bipartitus,

[1] A novel explanation of duplicity of the uterus and vagina was published in an American medical journal a few years since: "There was a superabundance of formative material directed to these parts, and in consequence of the richness of the vitalizing substance the consequence was the formation of double organs."

and in the other as semiseptus, or semipartitus. None of these anomalies prevents pregnancy—even plural pregnancy has been observed in the one-horned uterus, each child being perfectly developed; a fœtus may occupy each half of a double uterus, and normal labor occur at different times, showing that the conceptions were not contemporaneous. Preg-

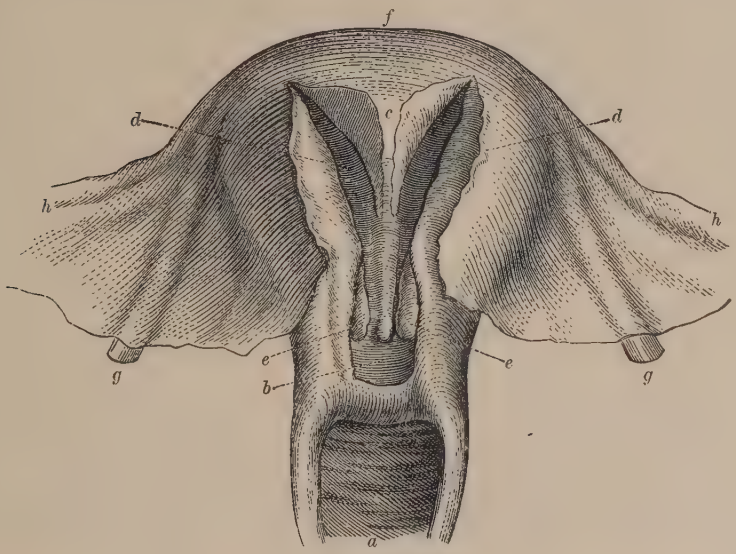
FIG. 53.

BIFID UTERUS.

nancy in one horn of a uterus, especially if there be but a single horn, very closely simulates an extra-uterine pregnancy, and doubtless has in many cases been mistaken for it.

Illustrations of some of these anomalies are presented in Figs. 50–54.

FIG. 54.



PARTITIONED UTERUS.

THE MAMMÆ. During the first period of life external to the mother the young of the class of animals known as mammiferæ are nourished by the secretion from certain glands of the mother which are

called mammæ, while in intra-uterine life they were nourished by her blood. The word mamma is from the Greek μάμμα. It is remarkable that in many different languages almost the same word is applied to an organ so essential for the growth and development of the infant, and that this word is usually the one first spoken by the child.

The mammæ are usually two in the human female; they are situated one on each side of the chest[1] anteriorly, between two layers of the superficial fasciæ upon the pectoralis major, corresponding with the space from the third to the seventh rib, and separated from each other by the space over the sternum; this intervening space is the bosom. They are rudimentary in the male, and are also rudimentary in the female until she approaches puberty, when they notably increase in size, but only attain their complete development under the stimulus of pregnancy followed by lactation. The probable suggestion has been made that when females through a few successive generations fail to nurse their offspring these glands become permanently lessened in size.

In many, if not in most cases, the mammæ are of unequal size; though authorities differ as to which, the right or the left, is larger; it is probable that the right breast is the larger in the majority of cases. A curious observation is attributed by Ploss[2] to the Israelite physicians of the Talmud: The daughters of the wealthy class have the right breast better developed than the left, because of the garment worn over the right shoulder; while the daughters of the poor have the left breast the larger in consequence of using the left arm in drawing water and in carrying their younger brothers and sisters.

The mammæ are usually somewhat hemispherical in form; but they may be pyriform or conical, and are then by some regarded as indicating a more abundant secretion of milk. The volume of the breasts is not in direct relation with the vital power and force of the individual, nor do these organs if large necessarily indicate abundant supply of milk; in some women of delicate organization the breasts may be big; and, moreover, the great size in an individual may not be from increase of the glandular tissue, but from an abundant deposit of fat.

For convenience of description the breast, in regard to its surface, has been divided into three zones. One of these zones, the peripheral, is very much the largest, and presents a smooth, white surface, beneath which the veins may be seen; if the female has given birth to a child, it is not uncommon to find the skin marked by *striæ*, *lineæ albicantes*, similar to those found upon the abdominal wall. The second or middle zone is composed of the areola. The color of the areola is in striking contrast with that of the peripheral portion; it is a pale rose in virgins, but becomes dark in pregnancy in brunettes, while it changes only slightly in blondes or in those having red hair; the pigmentation occurring in pregnancy never entirely disappears. The areola is one to two inches, or 2.5 to 5 centimetres, in diameter. The skin of the areola contains many sebaceous glands, but in addition to these there

[1] Plutarch, De Amore Prolis, thus explains the position of the mammæ in women: Itaque quidem animalibus ventrum ubera desinunt, mulieri superne ad pectus nascuntur, ut in promptu sit osculari, amplectique et fovere infantem; nimirum quia pariendi et alendi finis est non necessitas, sed amor.

[2] Op. cit.

are from twelve to twenty papular or tubercle-like projections, sometimes called the glands or tubercles of Montgomery, though it would be more appropriate to give them the name of tubercles of Morgagni, for they were well described by him more than a century before the great Irish obstetrician wrote, in regard to the nature of which different views are held. Milk may be discharged or pressed out of them during lactation, a fact which, according to Sappey, results from a communicating galactophorous duct, arising from a supplemental lobule of the mammary gland, but they are essentially sebaceous glands. De Sinéty[1] and Duval, however, assert that they communicate with isolated miniature mammary glands; and according to Depaul, they are rudimentary nipples. Whether sebaceous glands or nipples, they are greatly enlarged in pregnancy, thus making one of the most distinctive mammary signs of pregnancy. Beneath the skin of the areola concentric circles of muscular tissue are found; these circles, widening as the periphery of the subareolar surface is approached, there cease; contrary to that observed in the peripheral portion of the breast, there is no layer of fat beneath the skin.

The third or central zone is that occupied by the nipple. This rises from the centre of the areola at a point corresponding with the fourth intercostal space; it is conical or cylindrical, rounded at the summit, and measures nearly half an inch, or twelve to thirteen millimetres, in height and nearly a third less in thickness. In some subjects, however, the nipple is retracted, so that its upper surface is level with or beneath the surrounding areola, presenting in the latter case a depression similar to the umbilicus. The surface of the nipple has nearly the color of the areola, and presents a somewhat rough appearance from the numerous thick-set papillæ beneath, and in these papillæ, according to de Sinéty, corpuscles of Meissner are found. It has no hair follicles, but is abundantly supplied with sebaceous glands; generally a pair of these glands is found at the mouth of each of the galactophorous ducts which open at the summit of the nipple; the only part of the nipple in which these glands fail is at its junction with the areola, a matter of some practical importance with reference to the occurrence of fissures at this point during lactation. The nipple is provided with both transverse and longitudinal muscular fibres; contraction of the former causes thelothism,[2] or projection of the nipple, from θηλή, nipple, and ὠθεω, to push, while retraction of the nipple results from predominance of the action of the longitudinal fibres.

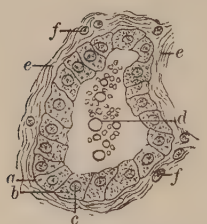
Beneath the skin of the peripheral portion a layer of connective and of fatty tissue is found; it becomes thicker at the external circumference of the organ; the skin is supplied with sudoriparous and sebaceous glands and hair follicles. The mammary gland is racemose, and is composed of fifteen to twenty lobes—ten to twelve, according to a recent authority—these being separated from each other by fibrous and fatty tissue; the gland mass is thicker at the centre than at the circumfer-

[1] De Sinéty, op. cit., states there are found upon the region of the areola, besides the sudoriparous glands, three other kinds of glands: simple sebaceous follicles, sebaceous glands divided into several lobes, and, finally, isolated true mammary glands, producing colostrum and milk under the same influences as the chief gland. The nature of these accessory mammary glands has been well established by Duval.

[2] Duval.

ence. Each lobe is formed of a number of lobules, and each lobule, in turn, of culs-de-sac, or acini. The structure[1] of an acinus from within out is as follows: First, a single layer of cubic cells; second, an incomplete sub-epithelial endothelium; third, the membrana propria; fourth, connective tissue abounding in cellular elements; and fifth, a fibrous tissue rich in elastic fibres and very poor in cells. A small duct passes from each acinus to unite with similar ducts from other acini, and by this union of ducts the larger duct of a lobule is formed; the ducts of the lobules of each lobe in their turn unite to form the excretory canal of that lobe, the galactophorous or milk duct. The ducts thus formed, and equal in number to the entire number of lobes, convey the milk to the upper surface of the nipple; at the level of the areola the ducts undergo a fusiform dilatation, and this dilated part is known as the lactiferous sinus. It is quite exceptional for the milk-ducts to anastomose with each other. The milk-ducts are lined with cylindrical epithelium; the ducts of the acini, near the latter, have the same lining as that of the glandular structure, and, like them, secrete milk.

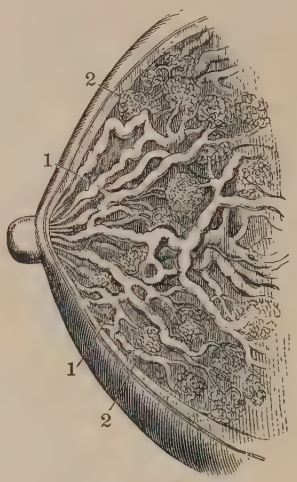
FIG. 55.



ACINUS OF THE MAMMARY GLAND OF AN ADULT FEMALE DURING LACTATION. (FROM DE SINÉTY.)

a. Epithelial cells. *b*. Nucleus. *c*. Nucleolus. *d*. Globules of milk. *e*. Fibres of connective tissue. *f*. Cells of connective tissue. Magnified 300 diameters.

FIG. 56.



STRUCTURE OF THE BREAST.

The blood supply of the breasts is by the internal and external mammary and intercostal arteries; the blood is returned through the internal mammary and the axillary veins. The lymphatic vessels are very numerous, and, as described by Sappey, form two planes. The first, or continuous, presents a very delicate network beneath the areola and the nipple; the second, or glandular, is deep-seated and is perilobular; the vessels do not penetrate into the lobules, but there are numerous lymph spaces in the connective tissue surrounding these. All the trunks from the deep layer of lymphatics are directed toward the areola, and they form a plexus remarkable for the size of the vessels;

[1] Duval.

from this plexus two, in some cases three, trunks pass to the axillary ganglia. The lymphatics of the skin communicate with the sub-areolar plexus. The nerves come from the fourth, fifth, and sixth intercostals, from the thoracic branches of the brachial plexus, and from the subclavicular branches of the cervical plexus. According to Winkler, the vasomotor nerves come especially from the brachial plexus.

Development and Anomalies of the Mammæ. "The first indication of the mammary gland is seen about the third month of intrauterine life, consisting of an in-growth of cells of the *rete mucosum*, surrounded by the fibrous tissue of the skin. At about the fifth or sixth month the rudimentary ducts of the lobules are apparent, springing from the central collection of cells."[1] At birth the lobes are distinct, and the milk-ducts open at the nipple. A painful swelling of the breasts is sometimes observed in the newborn, male and female; it lasts four or five days, and there can be pressed from the nipple a few drops of colorless viscid liquid, and finally milk.[2]

Polymastia is much more frequent than *amastia*.[3] The superfluous breasts are generally found in the axillæ, or below the normal ones, but they may be on the thighs, on the back, or in the groins; more rarely they are in the median line, but when here, unlike those placed in other abnormal positions, they do not secrete. There may be but one of these supernumerary organs, more frequently there are two, and a case has been reported in which there were five.

Absence of the nipple is very rare, imperforation less so, and imperfect development not at all uncommon. Hypertrophy of the nipple has sometimes been seen; in one instance this organ was as large as a pigeon's egg. Sometimes the increase of the nipple is in its length only; but even then it may be impossible for the infant to nurse. Imperfect development of the mammary glands is not infrequent, and examples of primiparæ, especially of those American-born, who cannot supply sufficient milk for their infants, are frequently seen. Many of these primiparæ whose secretion of milk is so scanty may after subsequent pregnancies have an abundant supply—a tardy development of the glands occurring.

[1] Shakespeare and Simes: Cornil and Ranvier's Pathological Histology.
[2] Bouchut: Traité Pratique des Maladies des Nouveau-Nés.
[3] William Sneddon, M.D.: Numerical Anomalies of the Breast.

CHAPTER III.

PUBERTY—OVULATION—MENSTRUATION.

PUBERTY is that epoch in human life when the individual first becomes capable of reproduction. It occurs about two years earlier in the female than in the male, and the physical[1] and psychical changes characterizing its advent are more marked in the former than in the latter. The girl's pelvis enlarges and her breasts notably increase in size as she enters this period of life; the one change indicates preparation for childbirth, the other provision for the nourishment of the newborn. The external genitals are developed, and hair grows upon the mons veneris and upon the labia majora; the circumference of the neck is greater, and the voice changes; the body is fuller and more gracefully rounded; sharp, irregular, and angular outlines are replaced by symmetrical curves, and new beauty of form and of general expression is manifested—it is the springtime of female life, the bud unfolding into the flower. The girl passing into womanhood puts away childish things, turning from frivolous amusements, from the toys and plays, or from rude sports in which she has found pleasure; she enters a new life, has new thoughts, desires, and emotions. Hitherto she has been living solely in and for the present; but now the future with its lights and shadows, its hopes and fears, makes a large part of her life. She is more sensitive and reserved, and manifests a modest dignity, giving and anticipating respect; her individuality becomes more manifest, her sense of duty stronger, and her ambition greater.

This remarkable transformation is the expression of important changes in the internal generative organs, especially in the ovaries, for if the latter be absent or undeveloped, the distinctive sexual characteristics fail. During infancy and childhood the ovaries slumbered; nature's forces were busy building[2] up the individual, and it is only when this end has been in good degree attained provision is made for the continuance of the race. The ovaries now awaken from their silent, inactive state, notably increase in size, and enter upon the discharge of their special function; they determine the sexual character, and for thirty years or more exercise a dominant influence upon the female organism; commonly designated as uterine appendages, in a true physiology the uterus ought to be regarded as their appendage. The function of the ovaries is the maturing and rupture of ovisacs, with the consequent escape of ovules which are thus offered for impregnation; this process is known as ovulation, and as it occurs independently of sexual congress, it is called spontaneous ovulation. Until recent years physiologists have generally held that ovulation normally occurs at regular

[1] See Bland Sutton's work contradicting this.

[2] Spiegelberg.

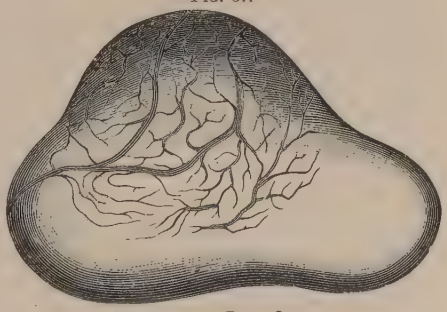
periods, but many now maintain that this is not true, and that the ripening and rupture of ovisacs go on independently of definite times; in a word, that ovulation is not periodical.

During her reproductive life the human female has, unless pregnant or nursing, once a month a discharge of blood from the uterus, usually lasting from two to six days. This discharge is frequently called the menses, or months, and during it the subject is said to menstruate, each term pointing to the periodicity of the occurrence. But, as will be explained hereafter, menstruation is not such a simple process, and the external flow is the mere sign of more important changes occurring in the ovaries and uterus, especially in the latter.

While reproduction is possible at the beginning of puberty, science and experience alike condemn such early exercise of this important power. As in the male, premature exercise of the sexual organs is, to use the words of Hufeland, the surest means of inoculating old age, so early maternity brings increased morbidity and mortality to the female, while her offspring will be less well developed, have less vital power, greater liability to disease and to early death than they would have had that maternity been delayed; the general law of both animal and vegetable world is that early reproduction gives an inferior product. Woman's form is not, as a rule, well developed before she is twenty years old; her pelvis, which has been called the laboratory of generation, has not attained its perfect shape until then; hence an early maternity is not advisable. Moreover, she lacks the mental and moral growth necessary for the grave responsibilities of motherhood. Modern physiology and large experience confirm the judgment of Plato, the wisest of Greeks, in his rule that "A woman may bear children to the State at twenty years of age."[1]

The physician, whose duty is not only to heal the sick, but also to prevent disease and to improve the race, and hence who must be a teacher of men and women, should teach sound doctrine in regard to the injurious results of precocious marriage. Mothers especially ought to be taught, though some have learned the lesson by their own sad experience, that puberty and nubility are not equivalent terms, but stand for periods of life usually separated by some years; the one indicates capability, the other fitness for reproduction.

FIG. 57.



OVARY WITH RIPE OVISAC.

OVULATION. A brief statement of the process by which the ovule is liberated from the ovisac, and its following migration into the uterine cavity, will now be given. The ovigenous layer at birth forms almost the entire ovary, but soon after the bulbous portion begins to increase

[1] The Republic.

in size, while the former remains without notable change in bulk until the approach of puberty. As this period draws near several of the ovisacs grow rapidly; one of them becomes prominent by its great development; it may be as large as a cherry, and forms quite a projection from the surface of the ovary, as seen in Fig. 57.

The growth of the ovisac causes increased flow of blood to the ovary; the emergent veins of the bulb having larger and thinner walls than the arteries bringing blood to it, are compressed by the contraction of the muscular tissue they traverse, and hence an increase of vascular tension in the entire organ, including not only the bulb, but also the ovisac. The contents of the sac augment, and its walls are more distended; the increased fluid in the ovisac is by some attributed to the breaking-down of part of the cells of the membrana granulosa, or to a secretion of fluid by them; according to some, an intra-vesicular hemorrhage occurs, in many cases the blood forms a clot, and the effused blood is one source of the distention. Rupture of the ovisac at last takes place, caused chiefly by distention, but also by fatty degeneration of the wall at its peripheric pole. An assisting cause, according to some, is muscular contraction of the ovary which has been depressed at that part where the ovisac was growing, and which under the stimulus of increase of blood tends to efface that depression, thus lifting the ovisac out of its bed. Rouget believes that another factor in causing rupture is the action of the contractile coat of the ovisac. When the sac bursts the ovule surrounded by the proligerous disk escapes and is received by the oviduct. With the development of the ovisac there is a notable increase in the size of the ovary; this temporary increase affects chiefly the vertical and antero-posterior measurements, but only slightly the longitudinal measurement of the organ.

Various explanations have been given of the transfer of the ovule to the oviduct. According to Rouget, the real, the only possible mechanism, is that which depends upon the fact that the uterus, the ovaries, and the oviducts are formed of a common muscular membrane, and by the contraction of muscular fasciculi the pavilion is applied to the ovary so as to receive the ovule. In some of the inferior animals the ovary and oviduct are inclosed in a common capsule, and thus escape of the ovule into the abdominal cavity is effectually prevented. In the bitch this inclosing capsule has a narrow slit, but in the bear and otter, and in some other animals, it is entire. This formation is attributed by Rouget to an accident of evolution which has become permanent.

Some have attributed the transfer of the ovule to the oviduct to the contraction of the elastic wall of the ovisac. A less improbable explanation is that which rests upon the presence, as first pointed out by Henle, of a gutter or canal upon the upper surface of the tubo-ovarian ligament through which the ovule passes into the oviduct, its progress being caused by the movements of the cilia of the epithelium belonging to this structure. It has also been asserted that the transfer is effected indirectly by the movements of the cilia of the pavilion, causing a constant current to the oviducts of the fluid moistening the peritoneum; the presence of this current has been proved by the fact that coloring-matter introduced into the peritoneal cavity of animals is

afterward found in the oviducts and in the uterus. Cases of what is called the external migration of the ovule—that is, entrance of the ovule into the oviduct of the left side, for example, when it was discharged from the right ovary, are thus explained; the vibratile current of the oviduct receiving the ovule is stronger than that of the one nearest which it is when the ovisac bursts.

After the ovule has entered the oviduct its further passage to the uterus is secured by the movements of the cilia and by peristaltic contractions of the oviduct.

The experiments of Bruzzi[1] upon rabbits have conclusively proved that external migration of ovules occurs; thus, for example, he endeavored, but failed, to cause extra-uterine pregnancy by removing the ovary on one side and ligating the oviduct of the other ovary, but copulation was followed by normal pregnancy, thus proving that the ovules coming from the remaining ovary had passed through the pervious duct of the opposite side.

The ovisac—its size lessened by the escape of the ovule and its surrounding granular matter, and of serous fluid, and the rent through which these passed closing—undergoes certain changes, which result in its obliteration, the most notable of these being the formation of the *corpus luteum* or yellow body. As observed by Raciborski, the term "yellow," as applied to these bodies, is incorrect; for while true of them as found in the ovary of the human female, yet in many of the inferior animals they do not have this color; thus in the cow they are deep orange, in sows a whitish-gray, etc. Hence he proposed as a substitute for corpus luteum the word *metoarion*, from *μετὰ*, after, and *ὠάριον*, the ovule, and some have adopted it; but corpus luteum, with its plural corpora lutea, is in such general use by obstetric authors that it will be retained. The formation of the corpus luteum is due chiefly to hypertrophy of the *membrana propria*, or *reticulata*, of the ovisac; the yellow color results from refracting granulations[2] more or less colored, either free or contained in cells; lymph cells are also found; the endothelial lining, or membrana granulosa, does not participate in the formation of the corpus luteum. Raciborski asserts that an intra-vesicular hemorrhage occurs prior to the bursting of the ovisac, while Dalton's investigations have led him to conclude that the hemorrhage is simultaneous with or immediately after the rupture; still others regard the hemorrhage as not constant, but accidental and occasional, and should it occur the process of the formation of the corpus luteum is hindered rather than assisted. Benckhiser,[3] from his studies of the corpus luteum in swine, concluded that a coagulum was an inconstant and unnecessary condition for the formation of this body. I have examined very many corpora lutea in swine and in sheep, and have never yet found a blood-clot in the ruptured ovisac.

In consequence of the limited space offered, the membrana propria from its hypertrophy is thrown into folds like the cerebral convolutions; these folds project toward the cavity of the ovisac, and, crowded to each other from opposite sides, meet and then unite, thus obliterating that

[1] Annales de Gynécologie, Janvier, 1885.
[2] De Sinéty.
[3] Archiv für Gynäkologie, 1884.

cavity. The hypertrophy does not begin until after the ovisac has burst, and hence cannot be a cause of that event.

Fig. 58.

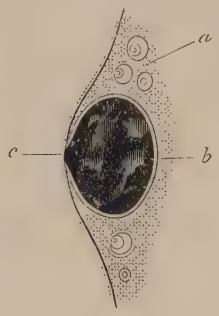


Fig. 59.

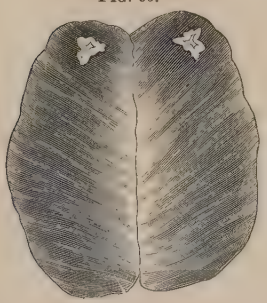
Fig. 58.—Graafian Follicle of the Human Ovary; recently ruptured during Menstruation, and filled with Coagulated Blood; Longitudinal Section.

a. Tissue of the ovary, containing unruptured ovisacs. *b*. Vesicular membrane of the ruptured follicle. *c*. Point of rupture.

Fig. 59.—Human Ovary cut open, showing a Corpus Luteum divided longitudinally.

The growth of the corpus luteum reaches its maximum in thirty days according to Dalton, in ten according to Coste, and is followed by atrophy, so that at the end of eight or nine weeks there remains of the entire mass a mere lamina of fibrous tissue, situated just beneath a pit or depression on the surface of the ovary, marking the place where the ovisac burst; according to Robin, there may also be found, in some cases, fat globules, or free fat, and amorphous or crystalline coloring-matter. During the regression of the corpora lutea the color becomes much lighter—white, instead of yellow—so that they are sometimes called corpora albicantes.

Fig. 60.

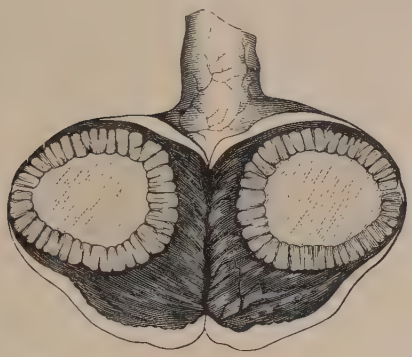


Human Ovary: showing a Corpus Luteum, Nine Weeks after Menstruation. From a Girl Dead of Tubercular Meningitis.

True and False Corpora Lutea. Should the ovule be impregnated, the corpus luteum reaches a larger size and continues longer. Hence a distinction has been made between the corpus luteum of menstruation and that of pregnancy, the one being called false, the other true. But such terms are misleading, for these bodies, though, as before said, differing in size and duration, are essentially the same. The history of the corpus luteum of menstruation has been given. The corpus luteum of pregnancy grows for thirty or forty days after conception; it then remains stationary until the end of the fourth month, when it begins to lessen, so that at the end of nine months it has only two-thirds its greatest size, and in a month after delivery is reduced to a small, indurated mass. In some cases, however, the growth of the corpus luteum of

pregnancy may continue longer than has been indicated, while in others the regression may be more rapid; there is no absolute, only a general rule applicable to either.

FIG. 61.



CORPUS LUTEUM OF PREGNANCY AT THE END OF FOURTH MONTH. FROM A WOMAN DEAD BY POISON.

FIG. 62.

CORPUS LUTEUM OF PREGNANCY AT TERM. FROM A WOMAN DEAD IN DELIVERY FROM RUPTURE OF THE UTERUS.

MENSTRUATION. This is a temporary and intermittent function of the female organism, and has as its most obvious phenomenon a discharge of blood from the genital canal. The function is temporary, for it does not begin until puberty, and it ceases in almost all cases when the reproductive period of life ends. It is intermittent, usually recurring at regular periods each month, but also presents longer intervals of absence, as during pregnancy and lactation.

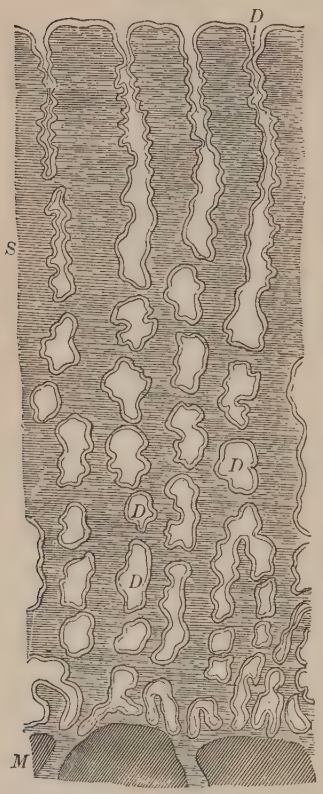
The study of menstruation includes that of its general and local phenomena, the character, duration, and quantity of the discharge, and its periodicity; the time of life when it begins, and that when it ceases; and the theories which have been proposed explaining its occurrence, especially in its connection with ovulation.

The general phenomena of menstruation are chiefly those connected with innervation and circulation. The reflex sensibility is increased; occasional chilliness and flashes of heat, neuralgic pains in various parts of the body may occur, and either light or grave manifestations of hysteria; some females during menstruation are drowsy, and few are disposed to exercise the usual activity of daily life, but rather seek rest, if not seclusion; sensitiveness to moral or to physical impressions is greater. There is in many cases congestion or irritation of various parts or organs of the body; the breasts may be swollen and painful; there may be sensations of fulness and throbbing pain in the head; the face is flushed in many cases, a dark circle is about the eyes, and an eruption may occur upon the skin; some are attacked with diarrhœa, many with irritability of the bladder; the thyroid gland is larger, and some have a mild tonsillitis.

The local phenomena are those connected with the generative organs.

The external organs are swollen and have increased sensibility; there is a feeling of fulness, of weight, and of "bearing-down" in the pelvis, backache, pain or increased sensibility referred to the iliac fossæ, and some fulness or meteorism of the lower part of the abdomen. Few women, at least among the civilized, when menstruating, are entirely exempt from physical discomfort, so that the expression, "being unwell," used for this function by many, is something more than a mere euphemism.

Fig. 63.



Section through Mucous Membrane of the Virgin Womb. (After Engelmann.)

S. Mucous membrane. *D.* Uterine glands with funnel-shaped stria. *M.* Muscular stratum. × 40.

Very important changes occur in the internal sexual organs. Increased determination of blood to these causes congestion, and in some a temporary hypertrophy. This transitory hypertrophy is especially manifested in the ovaries and in the uterus. The latter organ is increased in size one-fourth, one-third, or even more; its muscular fibres present a reddish appearance, and they are swelled and less firm. The mucous membrane, in consequence of excessive hyperæmia, is greatly swelled and thrown into folds, "recalling by its anfractuosities and projections the aspect of the cerebral convolutions;" the orifices of the glands are more distinct, and pour out an abundant secretion, which is the prelude to the sanguineous discharge. The vaginal cervix is swelled and softer, and presents a deeper hue than in the menstrual interval; the os is somewhat open. The mucous membrane of the vagina presents a dark red, in some cases a violet color; it is swelled, and there is a slight elevation in its temperature. The phenomena of congestion and increased secretory activity are followed by hemorrhage.

The hemorrhage results from the hyperæmia being so great that, according to some, rupture of the capillaries of the mucous membrane of the cavity of the body occurs. Menstruation, in its congestion and discharge of blood, has been called a diminutive of pregnancy, while Baudelocque called it a periodical abortion. The capillary tension immediately preceding the rupture of these vessels is explained by contraction of the muscular fasciculi inclosing the vessels of supply and return, this contraction affecting the veins more than the arteries, in consequence of the thin walls of the former, and by contraction of the muscular rings surrounding the large uterine veins.

While rupture of the capillaries is chiefly due to their great distention, fatty degeneration with detachment of the superficial epithelial cells is held by some to facilitate this rupture.

This statement is according to Dr. Engelmann's researches. Williams asserts[1] that the entire mucous membrane is cast off, thus leaving the muscular surface bare, and that a new mucous membrane is produced therefrom; the physiological objection to this theory is apparent and seems insuperable. Leopold states that fatty degeneration, instead of preceding and in any degree causing the menstrual hemorrhage, occurs during its progress. Fritsch[2] remarks that recently strong arguments have been adduced against these views, and that it is a mistake to attribute the hemorrhage to fatty degeneration, for in case of completely intact mucous membrane diapedesis occurs, the blood transuding from the vessels. We therefore return to the old theory which considered the hemorrhage as a result of the greatly swelled and distended vessels. Perhaps the arrangement of the vessels in the mucous membrane is important, for, according to Leopold, more vessels pass to than come from it.

Haller, Hunter, and many other illustrious physiologists and physicians regarded the menstrual flow as a secretion. Among American medical teachers, both the late Dr. Dewees and Dr. Hodge earnestly upheld this view. On the other hand, the late Dr. Charles D. Meigs[3] treated this opinion with unsparing ridicule, exclaiming: "I leave it to the student, therefore, to settle with his own judgment the question how can blood-disks be the subjects of secretory action? Can solids be secreted? Could not a woman as well secrete a watch or a diamond ring as one single blood-disk?"

No one now maintains the doctrine that the menstrual discharge is a secretion, but all consider it a hemorrhage, though different explanations are given of its occurrence.

CHARACTER, DURATION, AND QUANTITY OF THE MENSTRUAL FLOW. At the beginning of the monthly flow the discharge is chiefly serous or mucous, slightly tinged with blood; but as it continues the number of red globules increases until it is almost pure blood, having the color of that which escapes from a vein, though Dewees described the color as resembling that of mixed arterial and venous blood. The color, however, varies; thus, it may be very light and the fluid almost watery in the chlorotic, and excessively dark if there be great venous congestion. The odor of the menstrual fluid has been compared to that of the marigold; it is due, in most cases, to long retention of the fluid in the uterus or in the vagina, or else to the admixture of secretions from the genital glands. The fluid contains, in addition to red globules, white cells, globules of mucus, and epithelial cells from the uterus and from the vagina, the last increasing at the end of the discharge. It is alkaline, and usually does not coagulate; the non-coagulation is generally attributed to the intimate mixture of the secretion of the uterine glands with it, but Delore says that the blood flows so slowly from the uterus that it is in part defibrinated; however, the discharge of clots is frequently observed if the flow be profuse, and in some cases without this condition being present.

The quantity of the discharge was asserted by Hippocrates to be eighteen ounces, but the usual estimate is four to six ounces, or about 128 to 192 grammes. According to Tarnier, if the flow amounts to 500 grammes, or between thirteen and fourteen ounces, there is menor-

[1] Obstetrical Journal of Great Britain and Ireland, 1875.
[2] Krankheiten der Frauen.
[3] Obstetrics: The Science and Art.

rhagia. Sims suggested that by the number of napkins needed in twenty-four hours the quantity could be determined, in a normal menstruation only three or four napkins being required in that time.

Many have regarded climate as an important factor in determining the duration of a menstrual flow; among recent authorities, for example, both Playfair[1] and Harris[2] refer to this flow as being more profuse in warm climates; cold climates, on the other hand, have been thought to lessen the flow. This belief is erroneous, and, according to Raciborski,[3] is especially founded upon the old theory of menstruation which regarded it as resulting from plethora. He quotes the statistics of Faye, of Christiana, and of Peixoto, of Rio Janeiro, showing that the menstrual epochs and the quantity of the flow in these climates present the same variations which are met in central Europe. Saint Vel, whose observations were made in Martinique, regarded climate as without influence, but attributed the menorrhagia from which European women might suffer as owing to the anæmia resulting from malarial infection, and thus they were predisposed to increased flow. The observations of Hewan upon menstruation in women upon the coast of Old Calabar showed that the flow lasted from three to four days; and those of Rochebrune[4] in regard to this function in the Woloff negresses, that it lasted only three days and was slight.

F. Weber[5] has shown that at St. Petersburg the early or later beginning of menstruation has but a subordinate influence in the amount of the discharge; but he attributes an important *rôle* to the bodily constitution and the color of the hair. He rejects the opinion that menstruation is more profuse in brunettes than in other women, since it is very often abundant in blondes, and especially in women with red hair.

A generous diet increases the flow, while it is lessened by scanty and unsuitable food. Excessive sexual intercourse may cause the flow to be greater, and so, too, a profound mental impression—though in most cases this arrests it—may for the time have such an effect. Idiosyncrasy in many cases has an important influence, and, as so earnestly asserted by the late Dr. Hodge, every woman is a law unto herself as to the quantity of the monthly discharge, so that a physiological amount in one may be pathological in another. The best criterion of a normal flow is the effect upon the general health; if that be not injuriously influenced, the flow is neither too great nor too small.

Hippocrates declared that the menstrual blood was as pure as that of a victim. Nevertheless this just opinion has not been held by primitive people; among them the menstruating woman was unclean,[6] and even one of the most learned of ancient Romans, Pliny,[7] has attributed to

[1] System of Midwifery.
[2] Notes to Playfair's Midwifery.
[3] Traité de la Menstruation.
[4] Revue d'Anthropologie, 1881.
[5] St. Petersburger med. Wochenschrift, 1883.

[6] The Mosaic regulations as to menstruation are well known. It is stated by Raciborski and others that these were founded upon a wise hygiene, since the investigations of Diday, of Lyons, have proved that a chronic urethritis in the male may be caused by coitus during menstruation; moreover it is probable that the menstrual fluid would have peculiarly irritating properties in the climate of Egypt. Even during some of the earlier Christian centuries women were considered unclean while menstruating, and not allowed to partake of the "communion." Ploss observes (op. cit.), after referring to the general belief of the uncleanness of a menstruating woman, and the regulations to which she was then subjected: "We find such rigid rules, in which hygiene and religion unite, especially in the Indo-German race, in the Indian, as well as in the Semitic, Jewish, and Arabian."

[7] He asserted that at the approach of a menstruating woman must was made sour, seeds touched by her became sterile, garden plants are from like cause parched, and grafts wither; the fruit falls

the monthly discharge such serious results that his statements are amusing from their absurdity.

Recurrence and Duration of the Flow. The intervals between menstruations are not the same for all women, and in rare cases only, the same for the individual; variations of a day or more are frequently observed, the flow either delaying or anticipating, in most women. The terms menses, catamenia, "monthlies," Monatsfluss, etc., point to the monthly recurrence of this function; so, too, the word moons, used by the Chinese for this flow, has similar significance; it also points to the old belief of this function being subject to lunar influence. Goodman's statistics show that from the middle of one menstruation to the middle of the next is a fraction under twenty-eight days, or nearly one lunar month.[1] On the other hand, according to Dubois and Courty, the typical interval is a solar month; this is also the statement of Stoltz. Deviations from this interval may be observed; thus, one woman may menstruate every three weeks, or even more frequently, while another may have the flow only once in six or eight weeks.

The duration of the discharge varies; usually it is from three to six days; it is probable that, as stated by Hippocrates, a larger proportion of women have the flow three than any other number of days. In some the discharge lasts but one or two days, while in others it continues eight or ten. In this, too, we are reminded that every woman is a law unto herself.

Causes Influencing the First Menstruation. *Climate.* In temperate climates girls usually begin to menstruate when from thirteen to fourteen years old; in warm climates the function occurs earlier, in cold later. Raciborski[2] states that a year's difference in puberty corresponds to a difference of eight or nine, sometimes of only four degrees of latitude His tables, including 25,952 observations, show that there is a difference of three years, ten months and thirteen days between the time of the first menstruation of girls living in Central Asia and that of those living in Lapland. Krieger[3] gives, as the two extremes, eighteen years in Swedish Lapland and ten years each in Egypt and in Sierra Leone.

Race. The daughters of English residents in India do not menstruate so early as Hindoo girls. Negresses born under the burning sky of Africa or of South America menstruate early, and those born in Europe are equally precocious.[4] The Jewish race, which so strikingly keeps its individuality in all ages and places, and among all peoples, shows in regard to the first occurrence of menstruation but little difference of time, no matter what differences of latitude are compared.

Residence. Girls living in cities usually menstruate earlier than those living in the country. The country girl has a simpler diet,

from trees beneath which she sits, her glance dims the brightness of mirrors, blunts the edge of steel, and removes the polish from ivory; dogs licking the discharge are seized with madness, and their bite is venomous and fatal.

There may be appended to this terrible invective the statement that one of the fables as to the death of Lucretius is, that his jealous wife compelled him to drink menstrual blood, and madness with death followed. Paracelsus asserted that the devil made of this discharge spiders, fleas, caterpillars, and all other insects that infest the air or earth.

[1] Transactions of the American Gynecological Society, vol. ii.
[2] Op. cit. [3] Die Menstruation. [4] Depaul.

breathes a purer air; she has regular and abundant time for sleep, and is much less exposed to special causes of nervous excitement which are so prevalent in cities.

Theatres, dances, novel-reading, frequent association with the male sex in schools or in society, too constant or improper musical culture, too rich and stimulating food, witnessing, if not at times participating in fashionable life, are among the factors which hasten female puberty in cities. It has been stated by physiologists that girls working in factories or elsewhere, constantly associated with males, have in many cases precocious menstruation. On the other hand, there are many girls in our large cities whose puberty is delayed. These are found among the very poor. They have insufficient food, are poorly clothed and housed, denied fresh air and sufficient rest, and compelled to toil beyond their strength; their growth is checked, their bodies stunted, and hence failure in the vital power needed for sexual development.

Heredity. This influence, independent of race, is observed in some cases. Thus a mother menstruates early or late, and the peculiarity is transmitted to her female descendants.

The Genital Sense. The genital sense has been defined by Raciborski as the greater or less vigor shown in the development of ovisacs; it varies greatly in individuals, and has an important influence in determining the time of the first menstruation. In some cases it proves superior to the influence of climate, and hence there may be precocious menstruation in cold, and delayed menstruation in warm climates. It is often hereditary. Precocious menstruation is to be attributed to the great power of the genital sense. Some years ago I reported[1] a case in which menstruation began at three years and a half, and continued regularly. Ploss has collected forty-five instances of precocious menstruation, the oldest of the subjects being in her eighth year. But in some of these girls there was disease of the ovaries, in others hydrocephalus, and in still others rickets; nevertheless, the majority were healthy. In some instances of precocious menstruation precocious maternity was observed.

Raciborski has given the name of emmenic monstrosities to infants or children who menstruated.

Apathy of the genital sense is manifested by delayed menstruation[2] in persons whose health is good. This delay may extend to four or five years, or even a longer time, beyond the period when menstruation usually begins; in some cases menstruation did not occur until after one or more pregnancies, but of course the probability of conception prior to the establishment of this function is very small.

The Menopause. The menopause, from μήν, month, and παῦσις, cessation, is the end of the menstrual life. It is influenced by various causes, such as social condition, climate, and race; and hence presents as great differences in time as does the beginning of menstruation. The menopause occurs somewhat sooner in the poor than in the rich, prob-

[1] Cincinnati Journal of Medicine, 1866.

[2] According to Villaret, Joan of Arc was "exempt from the tribute which women pay the moon;" and he suggests that this exemption was due to her high destiny. She was only twenty years old when executed, so that, admitting the fact of her amenorrhœa, it is possible there was simply delay in the establishment of menstruation.

ably earlier in cold than in warm climates, and also in the black races than in the white. Some cease to menstruate in the third decade, while in others the function is continued into the sixth; thus Courty mentions the case of a woman who still menstruated regularly at sixty-five years. Charpentier states that in a woman under his observation menstruation ceased at forty-eight, but, after being absent for twelve years, returned, and continued for two years, the recurrence and quantity being normal.

The following remarkable case was recorded by the most eminent of American physicians, Dr. Rush :[1] "I met with one woman, a native of Herefordshire, in England, who is now in the one-hundredth year of her age, who had a child at sixty, menstruated till eighty, and frequently suckled two of her children, though born in succession to each other, at the same time. She had passed the greatest part of her life over a wash-tub."

Gibbon[2] states that Asima, the mother of Abdallah, when she was ninety years of age, upon hearing that her son was dead, had her menses return. Elsewhere we are told that the flow was fatal in five days. Such hemorrhage and at so advanced an age would not be regarded by a physician as menstruation.

If the puberty be early, the menopuse will be late, while on the other hand delayed puberty indicates early cessation of the monthly flow. According to Pétrequin's[3] statistics, one-eighth of women cease to menstruate when between thirty-five and forty years of age, one-fourth from forty to forty-five, one-half from forty-five to fifty, and one-eighth from fifty to fifty-five.

The obstetrician should remember that as girls have conceived before menstruating, so conception has occurred months and even years after the menopause.

Theories of Menstruation. Connection between Menstruation and Ovulation. Probably the earliest theory of menstruation is the chemical, or that which holds that certain materials which would otherwise be injurious to the organism are eliminated by the discharge. This view was to some degree expressed by pronouncing a woman unclean during the flow; even to-day, as remarked by Fritsch, the expression *monatliche Reinigung*, monthly cleansing, is retained.

In recent years the doctrine has to a slight degree found a scientific basis in this, that the quantity of carbon burned by man increases up to thirty years, while in the female who menstruates it remains the same, and hence, according to Aran, menstruation serves to eliminate a certain amount of carbon from her organism.

Dr. H. Newell Martin[4] suggests that there may be some truth in a modification of the purification theory, saying: "One important function of the mucous secretion of the alimentary canal appears to be that the mucus entangles and carries on with it to the rectum indigestible and other possibly harmful solid particles, as microbes. The uterus not merely cleanses itself by secretion and expulsion of mucus, which

[1] Medical Inquiries and Observations, 1793, Philadelphia.
[2] Decline and Fall of the Roman Empire.
[3] American System of Obstetrics, vol. i.
[4] Quoted by Tarnier.

might sweep and cleanse its lining membrane, but discharges during menstruation all the superficial parts of that membrane. We know that lying-in women are especially liable to be infected by pathogenic bacterial organisms; and in the earlier stages of its evolution, when the egg is still segmenting and the decidua reflexa forming, it may well be that the young embryo might be easily infected by extraneous organisms. This view gives us one logical meaning for menstruation. It gives us a reason for that entire casting off of the surface layers of the mucous lining of the womb which occurs each month. Menstruation breaks down and discharges all the old mucous membrane, and gets rid of bacteria which may have entered through the os and found a suitable nidus for development. Hence, in a modified form, the purification doctrine is still tenable as giving a physiological reason for menstruation."

This ingenious hypothesis is open to two objections. All observers do not teach the breaking down and discharge of "the old mucous membrane" as a phenomenon of menstruation, and according to some of the best it does not occur; the presence of pathogenic microbes, or microbes of any sort, in the healthy uterine cavity has not been proved, but disproved.

The theory that the flow results from plethora is one of the oldest and most generally adopted. As the woman had to nourish the unborn babe she was supposed to be endowed with superior blood-making power. But if she did not conceive, a superfluous quantity of blood was made, and nature brought the entire amount in her body to the normal level by periodical hemorrhages from the womb.

Some made the function peculiar to civilized women. Thus Roussel asserted that in the primitive or savage state women were exempt from menstruation; hard work and simple fare prevented them from being plethoric, and hence no hemorrhage occurred, as it was not needed; but it was necessary in the case of civilized women, because they had less exercise and more abundant and better food.

Auber also denied that menstruation occurred in savage women, and asserted that it happened in the civilized because of failure to gratify the reproductive instinct, and thus became a habit.[1] Some recent writers, too, have sought to establish the pathological character of menstruation; in other words, menstruation is a disease which impregnation would prevent. For the moment, admitting that Auber's theory is correct, that is, menstruation occurs from failure to satisfy the reproductive instinct, it has been suggested that a girl might be impregnated prior to menstruation, and then as soon as possible after her delivery let her be again impregnated, and thus through her entire reproductive life. At the end of that life she would have given birth to thirty or forty children, and if her example were to be generally followed, society would demand a new proclamation of Malthusianism. It is hardly necessary to state that menstruation occurs in savage women, and there is not the slightest

[1] Dr. Gill Wylie, of New York, has recently given (American System of Gynecology) a quasi-indorsement to the civilization theory of menstruation: "Although the generative organs are essential to reproduction, they are not essential to the individual, and are not necessarily used. Therefore, menstruation may be intended to take the place of the free exercise of the function of these organs, and thus compensate for the restraint and disuse so much and so necessarily practised by civilized races."

probability that at any period in the history of the race in any land women ever lived who, as a rule, became mothers without being subject to menstruation. It has been suggested that the menstrual hemorrhage is for the purpose of relieving a local plethora, that of the sexual organs, especially of the uterus, hypertrophy of its mucous membrane with consequent formation of a deciduous membrane being thus prevented.

Pflüger regards the uterine hemorrhage as a preparation for the attachment of the fructified ovum to the uterus. Menstruation, according to him, is the inoculation wound of nature for the fastening of the impregnated ovule to the maternal organism.

Dr. John Goodman has advanced the theory that menstruation is dependent upon a law of monthly periodicity. This law is the resultant and exponent of recurring cycles of physiological acts; these monthly cycles are supposed to depend upon the ganglionic nervous system. But, as remarked by de Sinéty, to attribute the flow to the nervous system explains nothing.

Passing from these theories, which have little more than mere historical interest, we turn to that which is founded upon ovulation, and which, though different explanations of the relations between the two phenomena may be held, meets with general professional acceptance. The view that has hitherto been commonly received, and is still held by many, is that ovulation is periodical, the growth and rupture of an ovisac corresponding with each menstruation. As the ovisac grows it presses upon ovarian nerves, and by reflex irritation causes congestion of the internal generative organs, especially of the uterus: the uterine hyperæmia results in hemorrhage from its mucous surface. Here the question arises as to whether this hemorrhage is facilitated by desquamation of the superficial epithelium, resulting from fatty degeneration, complete casting-off of the mucous membrane being rejected. According to some, this superficial desquamation does not occur until the close of menstruation, and therefore has nothing to do with the hemorrhage. Again, excellent authorities state that they have failed to find the proof of elimination of the superficial portion of the mucous membrane in menstruation. De Sinéty, in examining the discharge during the monthly flow, could not discover the least fragment of mucous membrane or of epithelium; so, too, in women dying while menstruating, he found the uterine mucous membrane entire in all its extent. Winckel[1] says: "Since Ruge and Moericke have found that during menstruation the ciliated epithelium of the uterine mucous membrane remains intact, an observation which we have repeatedly confirmed, the earlier view that during menstruation a fatty degeneration of the superficial layers was a cause of menstruation is incorrect."

Admitting these statements, the necessary conclusion is, that the hemorrhage in menstruation occurs without destruction of any part of the uterine mucous membrane, and that the blood escapes from the superficial vessels, not by their rupture, but by diapedesis and through an intact mucous membrane.

The periodicity of menstruation can be most readily explained by attributing it to the ripening of an ovisac, for this, like other processes

[1] Lehrbuch der Frauenkrankheiten, 1886.

of growth, would naturally be supposed to require a certain time. Again, this interpretation of the connection between ovulation and menstruation corresponds with what we know of ovulation and "rut" or "heat" in animals, which is the analogue of menstruation. Nature's legislation is general rather than special, and it is not probable she would make one law relating to reproduction for animals in general, and then a special law for human beings.

But without pressing this point, let us see the proofs that are adduced to show that ovulation is not periodical. The results of Leopold's investigations are thus given by Foektistow:[1] Fully developed follicles, those already ruptured, and fresh corpora lutea may be found at any time during the inter-menstrual period. These may not be present during menstruation. Hence ovulation occurs without menstruation, and menstruation may occur without simultaneous rupture of the follicles. Ovulation, therefore, is independent of menstruation, and is not periodical. Nevertheless, while Leopold denies the dependence of menstruation upon periodic ovulation, he does make it depend upon the ovaries, and he regards its periodicity as placing it in the category of rhythmical manifestations, *e. g.*, the pulse, respiration, or ejaculation of semen.

The uterine hyperæmia results as a reflex from the ovaries caused, not by the ripening of an ovisac, but by the continued growth of several. Foektistow, in answer to the question why does not menstruation occur more frequently, gives these reasons: Comparatively slight ovarian irritation is not sufficient to cause a reflex so soon. The essential, too, of the menstrual process, is that anæmia follows hyperæmia, and irritability ceases. Equilibrium is restored, and to cause another reflex another sum of irritations is necessary, and these cannot occur at once. The changes in the uterine epithelium which began with the hyperæmia pass away with the following anæmia, and the epithelium returns to its normal condition, a process which continues through more than one-half of the inter-menstrual period.

Another theory of menstruation which is founded upon ovulation is that of Lowenthal.[2] According to him, the ovule reaches the uterus before impregnation; if it be impregnated, menstruation does not occur; but if it is not impregnated, it excites a uterine congestion which ends in hemorrhage. Winckel[3] observes the Achilles heel of this bold hypothesis is that the death of the ovule can cause active congestion of the uterus. Further, this hypothesis is a revival of an old one; that is, menstruation results from the failure of impregnation, and is entitled to no more credence in its new that it was in its old form.

Auvard[4] holds that the menstrual function is composed essentially of two phenomena, ovulation and genital hemorrhage; these two phenomena are independent of each other, but dependent upon the same cause, this cause being unknown, and resulting from the constitution of the organism: in a physiological state they are associated, and on the contrary frequently dissociated in a pathological condition. He asserts

[1] Archiv für Gynäkologie, Band xxvii.
[2] Archiv für Gynäkologie, 1885.
[3] Op. cit.
[4] Travaux d'Obstétrique, tome premier, Paris, 1889. This hypothesis fails in adding to knowledge. It is no more satisfactory than Avicenna's explanation of the cause of labor coming on: "At the end of nine months labor occurs by the grace of God," or that of one of Molière's characters in regard to the action of opium: opium causes sleep by its sleep-producing properties.

further, that a genital flow simulating the discharge is not menstruation if ovulation is absent, any more than is ovulation without hemorrhage.

It may be, as stated by de Sinéty, that any positive theory of menstruation is, with our present knowledge, premature; nevertheless it must be admitted that this function is connected with the ovaries, for if these organs are congenitally absent, or if they are undeveloped, menstruation does not occur. So, too, after double ovariotomy menstruation ceases. The exceptions to this rule cannot be admitted until a careful post-mortem examination has proved that no fragment of ovarian tissue has been left behind in the lower portion of the pedicle, as has happened in some cases. Women have borne children after both ovaries were believed to have been removed. Olshausen performed, as he thought, ovariotomy, but the result being fatal he found at the autopsy that neither ovary had been removed. Further, even if both ovaries have been completely removed, possibly there may remain a supernumerary ovary, a condition that Beigel's and Winckel's examinations[1] prove to be far less rare than has been thought. Until in those cases of alleged perfectly normal menstruation[2] post-mortem examinations prove the entire absence of all ovarian tissue, either a fragment of an organ that has been removed or a supernumerary ovary, the doctrine that menstruation depends upon ovarian action will remain. So, too, it is in the highest degree probable that there is an intimate connection between ovulation and menstruation. At the same time it must be admitted that the two may be distinct, the one occurring without the other, though they are usually associated. Thus there may be occasional monthly hemorrhages without ovulation, or the latter may occur without the former. Ovulation may begin before the first monthly flow, and impregnation take place; during lactation it may occur without menstruation, and it may happen, too, after the menopause; thus there is an explanation of the comparatively frequent instances of impregnation of women while nursing; and of rarer cases in which this event has occurred after menstrual life has ceased. Further, there is reason, from what has been observed in the rabbit, for believing that coition may cause rupture of an ovisac, and hence ovulation occur independently of menstruation.

Ribemont-Dessaignes and Lepage[3] conclude that there is no good reason for not admitting, according to the classic theory, (1) that ovulation has its external sign in menstruation; (2) the escape of the ovule from the ovisac usually occurs at the end of a monthly flow, and generally this is the one that is fecundated.

[1] Beigel found in 500 sections supernumerary ovaries 23 times. Winckel from his own examinations concluded they were present in 3.6 per cent. Nevertheless, Sutton asserts, Surgical Diseases of the Ovaries and Fallopian Tubes: "So far as the evidence at present stands, an accessory ovary, quite separate from the main gland, so as to form a distinct organ, has yet to be described by a competent observer." But those who know Professor Winckel's ability and his thoroughness of investigation will doubt the error attributed to him in this quotation.

[2] Foektistow.

[3] Précis Obstétrique, 1893.

CHAPTER IV.

CONCEPTION—EARLY DEVELOPMENT OF THE IMPREGNATED OVULE —FORMATION OF DECIDUOUS MEMBRANES—FŒTAL APPENDAGES.

CONCEPTION, from *concipio*, means in metaphysics a grasping into one, and in physiology the uniting of two living elements, one male, the other female, from which a new being is evolved. Fecundation, impregnation, and by some incarnation are also used as synonyms.

A woman who has conceived is pregnant; pregnancy begins with conception and ends with labor. The pregnancy is single or simple if only one ovule has been fecundated, but plural if two or more have been. It is normal when the uterine cavity contains the fecundated ovule or ovules, and abnormal, ectopic, extra-uterine should it or they be external to that cavity. But whether the pregnancy be single or plural, whether normal or abnormal, its beginning is the same.

Human conception was a subject of great interest to students of nature, whether physicians or philosophers,[1] in ancient times;[2] numerous, and many of them very curious, hypotheses were proposed in explaining it, and indeed it is only in comparatively a recent period that, guided by the discoveries of the microscope, the initial step in reproduction has been placed upon a scientific basis.

Aristotle compared the menstrual blood to a block of marble, while the seminal fluid was the sculptor, and the fœtus the statue. Galen, who from his dissections had some knowledge of the ovaries, and gave them, as has been previously stated, the name *testes muliebres*, held that they furnished a secretion which in the womb combined with the seminal secretion of the male to form the new being. For many centuries these two opinions alternately prevailed, now one, and again the other, receiving the more general acceptance. But they were alike rejected by the recognition of Harvey's aphorism, *omne vivum ex ovo*. This illustrious physician maintained that reproduction in all animals was by a female element analogous to the egg of the hen. But in explaining the way in which development of the egg was effected he accepted the hypothesis of a seminal aura; fecundation occurred in like manner to the action of a magnet upon iron—contact with the former caused the latter to have magnetic virtue; again, he illustrated physical by mental conception—the uterus conceives the fœtus, as the brain ideas that are formed in it.

Confirmation of Harvey's views as to the essential element in human

[1] "A man deposits seed in a womb, and goes away, and then another cause takes it and labors on it, and makes a child. What a thing from such a material!"—Meditations of Marcus Aurelius Antoninus.

[2] "Drelincourt, an author of the last century, brought together as many as two hundred and sixty-two groundless hypotheses concerning generation from the writings of his predecessors; and nothing is more certain, quaintly remarks Blumenbach, than that Drelincourt's own theory formed the two hundred and sixty-third." (Allen Thomson.)

generation was for a time given by de Graaf's discovery of the ovisacs, which were believed to be human eggs, and at first were known as *ova Graafiana*. But about 1677, Ludwig Hamm, of Dantzic, examining with a microscope the discharge occurring in the nocturnal emission of a patient suffering with gonorrhœa, discovered living spermatozoids. He made known the fact to the great microscopist, Leeuwenhoek, who also saw them; the latter soon after found them in the seminal discharges of healthy men, of the dog, of the cat, and of the rabbit. Leeuwenhoek concluded from his observations that man was not produced—*ex ovis imaginariis, sed ex animalculis vivis seu vermiculis in semine virili contentis.* He asserted: *Sperma humanum parvulis puerulis esse plenum.* The supposed animalculæ received the name of spermatozoa, the plural of spermatozoon; but as these terms indicate that the objects are independent existences, a view now held by only few, it is better that they should be replaced by spermatozoid and spermatozoids.

Leeuwenhoek believed that the spermatozoids had sexual character, and some observers went so far as to describe their sexual organs. Of course, the Harveian theory of reproduction was for the time rejected; and this process was simply the development of one of these homunculi in the uterus, the female merely furnishing a nidus for that development.[1] But the progress of science has vindicated the truth of Harvey's theory as to the origin of the human being and of all animal life; it, however, gives no support to the hypothesis of a seminal aura, which acting upon the ovum causes its development. We now know that there must be an actual combination of the male and the female element in order that fecundation can occur.

The Seminal Fluid. The semen, when ejaculated, presents an appearance somewhat like that of thin, recently boiled starch; it is alkaline and mucilaginous, and has an odor which is called spermatic, and has been compared to that of hemp flowers or of horn filings. The odor, according to Robin, does not belong either to the spermatic or to any other of the secretions that combine with it during the ejaculation, but is developed by the mixture. Its specific gravity is somewhat greater than that of water; it is not coagulated by acetic acid or by heat, and does not contain albumin; but the substance found in it which has been by some given this name is spermatine; after it has become dry it presents upon the stiffened linen where it has been deposited yellowish-gray stains; the quantity discharged at a single ejaculation varies from fifteen grains to two drachms, one to eight grammes. Chemical analysis shows the presence of ninety per cent. of water, six of extractive matters, three of lime phosphates and muriates, and one of soda. In the sperm of the bull, Kölliker found 820 parts of water, 151 parts represented by spermatozoids, 26 by salts, and 21 by fat containing lecithine. In the sperm of some men there may be an excess of spermatozoids with a deficiency of water—all fish and no water, as Pajot has said—and sterility be the consequence. With the microscope there are seen cylindrical cells, pavement epithelium, leucocytes, fine

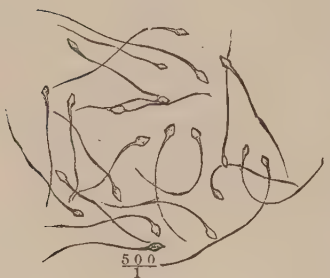
[1] The argument used in "The Furies" for the acquittal of Orestes for the murder of his mother would have been still stronger had the Greek poet known this view—for then indeed, as asserted in the successful defence of the matricide, the mother was only the nurse, and the father the true parent, and mythology tells us that Minerva had no mother, only a father.

granular matter, crystals of lime phosphate, and the essential element, the fertilizing agents, spermatozoids.

Spermatozoids. The form and size of spermatozoids vary in different animals, but there is no relation between the size of the spermatozoid and that of the animal from which it comes; thus the spermatozoid of the elephant is no larger than that of man, while that of the rat is five times as large. Waldeyer[1] states that the diversity of size and form of spermatozoids is astonishing, and that he does not know a single instance in which the spermatozoids of different animals are entirely similar, and he believes that their form may be advantageously used to determine their species.

The spermatozoid is composed of a head, of a tail, and of an intermediate segment, the last being thus designated by some, but by others called the body. The entire length of the human spermatozoid is not more than $\frac{1}{500}$ to $\frac{1}{625}$ of an inch, or one-twentieth to one-twenty-fifth of a millimetre. The head is pyriform, or ovoidal, the larger end being attached to the body or intermediate segment, while the smaller end is free. The head is about one-twentieth the length of the tail, and is quite or nearly twice as long as it is broad. The body, intermediate segment, or beginning of the tail, is only $\frac{1}{100000}$ to $\frac{1}{100000}$ of an inch, or one-three-hundredth to one-four-hundredth of a millimetre; it is oval and flattened, giving it somewhat the shape of an almond. The tail, or caudal filament, is thick at its origin, then gradually diminishes until its extremity is so fine as not to be visible even with the best magnifying glasses. One of the most striking characteristics of spermatozoids is the power of executing quick and rapid movements; these movements are especially rapid immediately after ejaculation; a spermatozoid moves a distance equal to its length in one second, and it was stated by the late Dr. Marion Sims that spermatozoids pass from the hymen to the neck of the womb in three hours. Lott states that spermatozoids in a minute move 3.6 mm., and Winckel adds that at this rate they might easily pass into the oviducts in a few minutes. The head is the part which always advances first; the movements have been compared to that of an eel swimming in water; the tail may be curved in a circle, but very quickly becomes straight again, and its simple undulatory movements, which cause progression of the spermatozoid, are resumed; in its progress over the field of the microscope, it may sometimes be seen quickly pushing out of its way epithelial cells or crystals ten times its size.[2] The movements gradually lessen, then there is no progression, but mere oscillations are seen, and finally all motion ceases; but by warming the slide, if it has become cold, or by adding a little warm water, slightly alkaline, if the liquid has become thick,

Fig. 64.



Spermatozoids. $\frac{500}{1}$

[1] Arch. f. mikrosk. Anat., August, 1888.

[2] Robin.

movements are resumed. In avoiding these two causes of death to the spermatozoids when the seminal fluid is placed between two glass slides, the movements may last for twelve, twenty-four, or even thirty hours.

Spermatozoids have been found alive in men who were executed seventy and even eighty-two hours after death; in the bull six days after it was killed; in the oviducts of bitches and rabbits seven to eight days; in the cow six days after copulation; in the human female they were found endowed with active movements in the cervical canal, by Hausmann, seven days and a half, and by Percy eight days after coition. In the female bat they retain their fecundating power for many months, and in the queen bee for more than three years. The spermatozoids of a frog may be frozen four times in succession without killing them. They will live for seventy days when placed in the abdominal cavity of another frog. (Mantegazza.) Acid solutions kill spermatozoids very quickly, and, on the other hand, weak alkaline solutions quicken or awaken their movements; cold water arrests their movements, and corrosive sublimate, one part to ten thousand of water, is destructive to spermatozoids, while they seem insusceptible to the action of poisons of organic origin.[1] The normal secretion of the uterus, as well as the menstrual discharge, is favorable to their movements. In the examination for spermatozoids a magnifying power of three hundred diameters is sufficient, but in medico-legal investigations one of five hundred is necessary.

In temperate climates boys of twelve years may have a discharge simulating the seminal fluid, but it is unusual for spermatozoids to be found in these discharges before the age of fifteen or sixteen years.[2] The reproductive power begins somewhat earlier in woman than in man, but it lasts much longer in the latter; Liegéois, from his investigations, concluded that about one-half of men between sixty and eighty years of age were capable of fecundation.[3]

Men who are addicted to sexual excess may have seminal discharges without any spermatozoids being present; so, too, spermatozoids may be absent in the case of some men who are in good health; thus Pajot found this condition in six of eighteen husbands whose marriages were sterile, and the late S. W. Gross stated, as an approximate estimate, that in one case in six of sterility the husband is at fault.

Recent authors greatly increase the number of cases in which the sterility depends upon the male; 35 per cent., Kehrer; 40 per cent., Lier and Ascher; and even 57 according to Noeggerath. (See *Traité pratique de Gynécologie*, by Bonnet and Petit, 1894.)

As has been previously said, the animalcular character once given to spermatozoids is now generally denied. The arguments against this view are: they have neither organs of digestion nor of reproduction; they are anatomical unities which have their genesis from embryonic male cells or spermatoblasts, but they do not produce such cells; they

[1] Duval.

[2] In the light of the statement above made as to the time spermatozoids are first found, the story of Cato being a father at eight years, as well as that said to have been told by St. Jerome, of a boy ten years old, who, sleeping with his nurse, impregnated her, is to be rejected.

[3] The illustrious Corvisart was skeptical as to the prolonged power of propagation, for when the First Napoleon asked him if a man at sixty could be a father, he replied, "Sometimes." "And at seventy?" then asked the emperor. "Always, sire."

indicate a finality, not a progress; they are regarded as similar to ciliated epithelium.

In order that fecundation can occur there must be an actual union between the male element and the female—between the spermatozoid and the ovule. In some animals external fecundation occurs, the eggs being fertilized after they have been expelled from the female; or, as in the frog and crab, while they are being discharged. But in human beings, as in most animals, fecundation is internal. The place of union, between the spermatozoid and the ovule, was supposed to be the uterine cavity, and this opinion is maintained by some eminent authorities, among whom may be mentioned Mayrhofer, Wyder, and Lawson Tait. But this opinion is generally rejected, because it does not explain the occurrence of ectopic pregnancy, and because the spermatozoids are found in the inferior animals to have entered the oviducts and advanced to the pavilions. Moreover, it is known that in some animals the ovule in its progress through the oviduct receives a covering of albumin[1] which is impenetrable by spermatozoids, and also that, unimpregnated, it is affected during this progress by degenerative changes which render impregnation impossible. It is therefore now generally held that fecundation takes place in the external third of the oviduct, possibly near or in the pavilion.

Ascension of the Spermatozoids. Four causes have been invoked to explain the passing of spermatozoids, deposited in vast[2] numbers in the posterior vaginal cul-de-sac at the end of coition, from this point into the external portion of the oviduct, supposing this to be the usual seat of fecundation. Three of these, that of capillary force, of aspiration, or intraction by the uterus, and of the movements of the cilia, make these bodies merely passive—they do not ascend, but are transferred or translated. But it seems probable that the spermatozoids would not have been endowed with such force and rapidity of movement unless for the accomplishment of an important purpose, and therefore we recognize the inherent power of motion on their part as the chief, usually the only, cause of their being in the oviducts. Intraction on the part of the uterus is impossible in certain structural diseases of the cervix, and is powerless when the seminal discharge has been from necessity or from precaution made upon the external sexual organs, and yet in each condition impregnation has been known to occur. Ciliated action would assist the spermatozoids once in the uterus to ascend to the oviducts, but the action of the cilia of the latter would oppose their further progress. It may be that Nature, rich in resources, does not limit herself to a single cause in securing this important step in the continuance of the race, but, while having a chief one, at times has this assisted by others.

In all cases more or less time intervenes between coition and conception, between insemination and impregnation; this interval possibly is some

[1] This argument is strengthened by Bland Sutton's discovery of glands in the oviduct, these glands secreting albumin, according to his view.

[2] Mantegazza admits the minimum period of fecundating power of man as from eighteen to fifty-eight years—that is, forty years, and stating that at each ejaculation the quantity of semen is 120 drops, and that a single drop is sufficient for impregnation, comes to the conclusion that a man can reproduce 480,000 times.

Startling as this statement is, that of Lode, quoted by Ahlfeld, is still more remarkable—the number of spermatozoids in coition discharged in the vagina is 226,257,900.

hours, and it may be, as illustrated by the fecundation of the hen's egg twelve days before it is laid, several days. Hence the assertion made by some women, and accepted by a few obstetricians, that a peculiarly pleasurable sensation attends fruitful intercourse, is to be rejected. The intercourse may be with cruel violence, or the woman may be paralyzed by fear, or submit with indifference, or even with loathing and disgust; she may be in profound sleep, drugged, or anæsthetized; or, finally, artificial introduction of the seminal fluid into the uterine cavity may be done, yet in all these instances fecundation can result. In such cases pleasure was impossible, and in some both mental and physical suffering were present. The *rôle* of woman in copulation is passive; the probability is her pleasure cannot promote nor her pain prevent conception.

The Combination of Male and Female Elements. It has been held that the spermatozoids after reaching the ovule were dissolved, then by osmosis penetrated its walls molecule by molecule, and the development of the ovule resulted; it was vivified by a sort of spermatic bath, and the richer the bath was in dissolved spermatozoids, the more certain would be impregnation. Another equally improbable explanation was that several spermatozoids entered the ovule, the greater the number entering the more certain the fecundation, and then were disintegrated and were mingled with the yelk. But the more recent studies of fecundation in some of the inferior animals render it in the highest degree[1] probable, and it is quite rational too, that in all cases only one spermatozoid is concerned in normal impregnation. It would seem that nature teaches the law of monogamy at the very beginning of life.

Certain changes occur in the ovule independently of impregnation. The germinal vesicle moves toward the periphery of the ovule, and from the vesicle there is formed a globule, which first presents as a bud-like process projecting from the surface of the ovule, then the part nearest the free surface of the ovule becomes constricted and separation follows; this process is repeated once, or oftener, and the bodies thus originating from the germinal vesicle, and ejected from the ovule, are called polar cells or globules. The formation of the polar cells[2] may occur while the ovule is still in the ovary, but more frequently afterward; they may precede or follow impregnation. These statements have been drawn from observation of the ova of some of the inferior animals; as remarked by Balfour, it is very possible, not to say probable, that such

[1] Van Beneden, in only six cases of many thousands of impregnation of the egg of the ascaris studied by him, found that two spermatozoids entered the ovule.

[2] The apparently useless formation of polar globules has been given different explanations. One is that these globules are ejected from the ovule in order to secure space for the segmentation of the vitellus. Another is that they testify to a descent from ancestral forms having a lower organization, in which the discharge of the globules plays an important part, as in the parthenogenesis of bees, etc. Balfour suggests as one of the reasons for the ovule having this function the prevention of parthenogenesis. It is the final act of the ovule; unaided it can do nothing more. "There is but little doubt that the ovum is potentially capable of developing *by itself* into a fresh individual, and therefore, unless the absence of sexual differentiation were very injurious to the vigor of the progeny, parthenogenesis would certainly be a very constant occurrence; and on the analogy of the arrangement in plants to prevent self-fertilization, we might expect to find some contrivance both in animals and in plants to prevent the ovum developing by itself without fertilization. If my view about the polar cells is correct, the formation of these bodies functions as such a contrivance." (Balfour: Comparative Embryology.) Thus parthenogenesis is prevented, and cross-fertilization made possible.

changes are universal in the animal kingdom, but the present state of our knowledge does not justify us in saying so.

It is generally held that the germinal vesicle is not entirely cast out in the form of polar globules, but a portion remaining in the ovule forms the female pronucleus, which is to unite with the male pronucleus. The latter is believed to be formed by the head alone of the spermatozoid. The entrance of the male element into the female is provided for in some fish by a minute opening, called a micropyle, in the covering of the ovule; this opening is so small that only one spermatozoid can enter at a time. But the ova of the mammiferæ show no such investment. Duval remarks that it is now proved that a great number of ovules at the time fecundation occurs are simply encircled by a pellucid zone—that is to say, a layer more dense, and having a special appearance, but which in a normal state is always fluid and permeable. Fol, of Geneva, states that putting in contact with an ovule liquids containing vibrions, the latter passed through this pellucid layer, and were found in the yelk; still more, then, this zone is permeable by the spermatozoid.

The vitelline membrane is a secondary formation, and is not found upon the unfecundated egg; but after the first spermatozoid has penetrated the vitellus the ovule is rapidly encysted by condensation of its peripheral layer, a kind of catalytic phenomenon the nature of which is not clear. It is thus seen that Nature provides for the entrance of one spermatozoid, but closes the door to a second, and if by mischance the latter enter, the result will be a double monster.

The part of the spermatozoid which enters the vitellus increases in size and is the male pronucleus. The male moves toward the female pronucleus, which occupies the centre of the ovule; the latter in some cases has been observed to lose its spherical form and become crescent-shaped, so as to receive in its concavity the male pronucleus. After the fusion of the two pronuclei there is but a single nucleus, in which are initiated all the changes that result in the formation of a new being. Balfour describes the act of impregnation as the fusion of the ovum and the spermatozoid, and the most important feature in the act appears to be the fusion of a male and of a female nucleus. This is brought into still greater prominence by the fact that the male pronucleus is the metamorphosed head of the spermatozoid, which contains part of the nucleus of the primitive spermatic cell, and the female pronucleus is the product of a primordial ovum. The spermatic cells originate in primordial cells, which cannot be distinguished from primordial ova, and thus the impregnated ovule results from the fusion of morphologically similar parts in the two sexes.

Time of Conception. This cannot be certainly known, but the time when coition is most likely to be followed by impregnation is well known by the public as well as by physicians. The "conception curve" given by Foektistow[1] shows that conception is most liable to occur from coition in the first seven days following menstruation; the first day after the flow ceases has the highest percentage, and from this time the

[1] Op. cit.

latter gradually declines. Hensen's conclusions are in accordance. But while conception is very improbable during a certain portion of the menstrual interval, it cannot be affirmed that it is impossible at any time.

Fate of the Spermatozoids not Concerned in Impregnation. As has been previously stated, it is almost certain that in human beings, as has been proved to be the fact in some of the inferior animals, only one spermatozoid is concerned in impregnation, and the question naturally arises, What becomes of the multitude who have no part in this process, a number much greater than Penelope's suitors during the long absence of Ulysses. Is it not possible that they may permanently modify the organism or the undeveloped ovules so that the product of a future pregnancy, though by another father, may be affected?[1] The heredity of influence is that observed in the children born by a widow who remarries, these children resembling morally and physically the first husband. Occasional instances of such heredity occur, and it is claimed that in reproduction in the inferior animals the first sire may materially modify the offspring of subsequent sires. Admitting the fact, possibly the factors in such modification may be the original spermatozoids that did not contribute to the first conception. Heredity of influence has also been termed indirect atavism, and more recently *telegony*. Lingard[2] has given a remarkable instance: The widow of a hypospadian eighteen months after the death of her husband contracted a second marriage, the new husband not being a hypospadian, and having no history of any such deformity in his family. Consequent upon this marriage she had four sons, all hypospadians.

Production of Sex. The essential causes of the differences of sex are not known. By Sadler and Hofacker the following conclusions were drawn as to the influence of age: If the husband be younger than the wife, there are as many boys as girls; if both are of the same age, there are 1029 boys to 1000 girls; if the husband is older, 1057 boys to 1000 girls. These laws are not to be accepted as conclusive. The normal proportion between female and male births is 100 to 105 or 106. But in the case of illegitimate births the proportion is reversed, at least for the children first born; that is to say, in such births females are more numerous than males. The proportion of male children to females is slightly greater in the country than in the city. The chances of the young wife having at her first pregnancy a boy are at their maximum, while those of the matron near the close of her reproductive life are at their minimum. Swedish statistics prove that in the nobility, the age of the husband being greater than that of the wife, there are only 98.3 male to 100 female births; this reverses one of the rules given by Sadler, according to which there ought to be a preponderance of male births. Bertillon states that the influence of the ages

[1] This is by some called *infection* of the mother. Doléris regards it as without positive proofs. He also quotes Colin as saying: If the male can indeed, in fecundating the female, exercise an action upon the eggs contained in the ovary, and which contribute to subsequent gestations, this influence is very difficult to conceive. — Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome xxxiv.

Modification of the ova was the view of the illustrious Haller, while fœtal inoculation of the mother was upheld by the late Professor Alexander Harvey, of the University of Aberdeen, in his little volume, Fœtus in Utero, London, 1886.

[2] Lancet, April 19, 1884.

of the parents upon the proportion of the sexes, if it exists, may be neutralized by the inherent qualities appertaining to the parents.

Kaltenbach calls attention to the fact established by Hecker-Ahlfeld, that there is a great excess of male births in old primiparæ, this being 124–140 : 100. He also states that in young colonies too, in which the number of females is, relatively to males, very small, so that not merely very young females, but also quite old marry, the excess of male births is very great.

Some have held that the sex was preformed in the ovule, and thus there are male and female eggs. Still another opinion held by some physiologists was that the greater vigor of one or the other, husband or wife, at the time of fruitful coition determined the sex, each sex tending to repeat itself. More recently the view that each sex tends to produce the opposite has been received with some favor. Thus, according to Janke,[1] if a boy be desired, the sexual sphere of the wife and her sexual appetite must be strengthened to the utmost by generous, even luxurious diet, while the husband lives more as a vegetarian ; a week after menstruation is the most favorable time for coition. Those who will consult Debay's work,[2] will find that Janke has been anticipated in his advice as to means for securing the creation of a male.

Mantegazza,[3] quoting from a report to the Anthropological Society of Berlin by Miklucho-Maclay, refers to hypospadias made for Malthusian purpose among some of the Australian tribes ; thus, in one tribe there were 300 mutilated, and only three or four left with the penis intact ; to this small number the continuance of the tribe was left, and the female births greatly exceeded the male.

Relative Influence of the Father and the Mother upon the Offspring. This subject is one of great interest. Runge, *Lehrbuch der Geburtshilfe*, 1894, refers to the old and widespread belief, illustrated by many examples, that the degree and condition of the intelligence are inherited from the mother, character and inclination from the father—this position being maintained by Schopenhauer. Goethe said : "From my father I inherit my frame and the steady guidance of my life ; from my dear little mother, my happy disposition and love of story-telling." Debay, in his work previously quoted, upholds this thesis : Physical and moral qualities are transmitted from the father to the daughter, from mother to son, and he adduces many illustrious examples as proofs. Galton, *Hereditary Genius*, finds one distinguished man among 4000 ordinary men, and one illustrious man in a million. In studying the relation between transmission by the male and by the female, that for statesmen, judges, literary and scientific men is as 70 to 30. Among poets and artists, too, maternal influence was much less than paternal. On the other hand, among theologians the female influence was represented by 73, that of the male being 27. It is shown, in regard to this class, "that the influence of the female line has an unusually large effect in qualifying a man to become eminent in the world."—Galton.

"It is seen," Mantegazza remarks in his *Hygiène de l'Amour*, "that Galton overturns a very popular belief, according to which great men almost always

[1] Centralbl. für Gynäkol., 1891.

[2] Hygiène et Physiologie du Marriage : Debay suggests that in order a boy shall be produced the wife must for twenty or twenty-five days before the impregnating coition live chiefly on nitrogenous food. There does not seem a greater probability of the truth of this theory of determining the creation of a male, than that of a recent writer as to the relation between nitrogen and evil : we might almost say boys and badness come from nitrogen. The writer referred to makes the following statement : "Every good thought increases the proportion of oxygen, as a deep breath does, and lessens that of nitrogen, making the body finer and more beautiful. Every evil thought or impulse that is indulged increases the nitrogen, and has the reverse effect on body and soul."—The Arena, June, 1894.

[3] L'Amour dans l'humanité.

have mothers of superior intelligence, while the father rarely transmits his genius to his son. Nevertheless I believe Galton is wrong, and that the common belief is reasonable; without collecting statistics, we know how great the amount of talent transmitted by the uterine way."

The excess of male over female births is somewhat greater in Philadelphia than the average, which is, 100 females to 106 males. In five years from 1868 to 1872, inclusive, the relation was 100 to a fraction over 110. In one year, 1870, the relation was 100 to a fraction over 113. In the five years from 1888 to 1892, inclusive, this relation was 100 to a fraction over 109.

TIME OF YEAR MOST FAVORABLE TO CONCEPTION. The subjoined table comprising the births in Philadelphia each month during two periods, each of five years—the first from 1868 to 1872 inclusive, and the second 1888 to 1892, also inclusive—shows the births in each month, the months being readily divided into three periods, maximum, mean, and minimum of births. There are also shown the months, similarly divided, in which conception occurs in relative frequency; the difference between March and July as conception months is very striking.

Month of birth.	Month of conception.	Number of births.
December	March	21,001
August	November	20,410
July	October	20,396
October	January.	20,178
September	December	19,934
January	April	19,812
November	February	19,288
March	June	18,745
February	May	18,407
June	September	18,402
May	August	17,555
April	July	16,886

The following is an abstract of statements made by Ploss[1] in regard to the influence of the seasons upon conception. The fact that there is an increase in the number of conceptions at certain times of the year does not indicate that there is a greater ability on the part of the female to conceive at these times, or any change in the physiological condition of the female sexual organs. The influence of the seasons upon the male is also to be taken into consideration. Villermé found that the maximum of conceptions in Europe occurs in May and June, and he attributed it to the influence of spring. In order to justify this opinion he extended his observations to those parts of the world where, while the seasons follow in the same order, they occur at different times, *e. g.*, Buenos Ayres, and found the results the same. The times when marriages are most, and those when they are least frequent, have no apparent influence upon the number of conceptions according to the season of the year. On the other hand, the periods of comparative rest, of hard labor, and scarcity of food have a marked influence. The number of conceptions is lowered by the harvesting season, scarcity of food, and by strict observance of religious fasts, as Lent. "Those conditions which strengthen us increase our fertility, and those which weaken or depress us, or especially such as undermine the health, lessen it, though fertility is by no means governed by health alone."

Wäppenhaus's conclusions from his studies of the birth-rate in Sardinia, Belgium, the Netherlands, Saxony, Sweden, and Chili are as follows: The maximum of conceptions occurs in May and June. The cause is the vivifying influence of spring, aided by the habits and customs of the church in all Catholic countries. There is a gradual decrease to the minimum, which is in September and October. The cause is in the increased heat of summer, and in the epidemic diseases resulting therefrom, aided by the hard work of harvest. In Sweden this maximum is in January. The cause is found in social customs and in the religion. The

[1] Op, cit.

dissipations incident to the period of Carnival, and the strict observance of Lent, lessen the maximum in Catholic countries.

In Italy the maximum differs in the north and in the south. In the latter it is in April, but in the former in July.

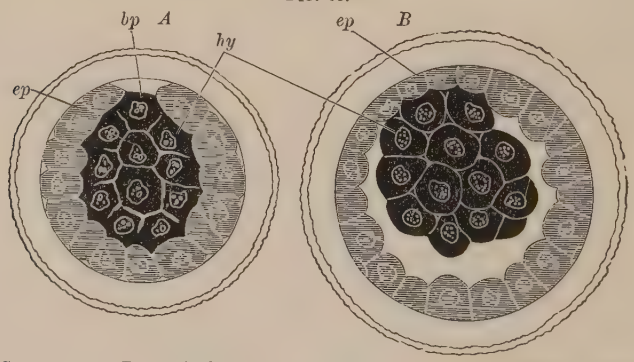
Illegitimate conceptions are more under the influence of physical conditions, *e. g.*, the seasons, than are legitimate conceptions. In western Europe the greatest number of illegitimate offspring are conceived in spring and summer, the fewest in fall and winter; the difference is much less marked in the conceptions occurring in the married.

In Russia the greatest number of conceptions occur in April and in January.

Changes in the Fecundated Ovule. The first of these changes is segmentation, or cleavage, the sphere dividing into two spheres. The process of division occurs in the nucleus first, and is followed by that of the vitelline mass surrounding the two newly formed nuclei, so that each new sphere has a part of the original nucleus. These spheres again similarly divide, thus the two become four, which also divide and eight are formed; subdivision after subdivision occurs until the entire vitelline mass has been converted into a number of minute spheres which from their supposed resemblance to a mulberry have been called the muriform body.

These spheres are unequal in size and fulfil different purposes in the process of organization. The larger and more transparent are called *epiblastic* from ἐπί, upon, and βγαστὸς, germ; the smaller *hypoblastic*, from ὑπὸ, under, and βγαστὸς, germ. The segmentation, too, is not simultaneous in the spheres after eight are formed, but begins in the epiblastic spheres; a cup-shaped cavity is formed by them in which the hypoblastic spheres are placed, making a solid central mass.

Fig. 65.



Optical Section of a Rabbit's Ovum at Two Stages closely following Segmentation. (After E. van Beneden.)

ep. Epiblast. *hy.* Primary hypoblast. *bp.* Van Beneden's blastopore.

It will be seen at the end of segmentation[1] that the epiblast cells are somewhat the smaller, that they are clear, and irregularly cubical in form; the hypoblast cells, on the other hand, are polygonal in form and granular and opaque in appearance. *A*, Fig. 65, shows an opening in the epiblast covering of the hypoblast cells; this opening is called the

[1] Balfour.

blastopore; it, however, is soon closed, as represented in *B*, Fig. 65, by the growth of epiblast cells.

After the segmentation and arrangement of the cells the ovum passes into the uterus; this is supposed to occur within five or six days after fecundation.

Formation of the Deciduous Membranes. Before tracing the further development of the ovum it is advisable to refer to the changes in the uterine mucous membrane incident to the beginning of pregnancy, the fitting up of the interior of the house in which the new being is to dwell during the many months of intra-uterine development.

It was formerly taught by John Hunter and others that the stimulus of pregnancy produced an inflammatory exudate upon the uterine mucous membrane, and thus a closed sac occupied the uterine cavity. The fecundated ovule could only enter the uterus by pushing before it that part of this new membrane which was in relation with the uterus in the immediate vicinity of the oviduct through which it came, and the mouth of which was covered; the portion thus pushed away, therefore, became a reflected membrane, and hence was called the *membrana reflexa*, while that which remained adherent to the remaining portion of the uterine mucous membrane was a true membrane, unchanged in its relations, and received the designation of *membrana vera*. Finally, the surface to which the *reflexa* had been attached was left bare, but a new exudate covered it, making a membrane which, because of its *late* formation, was called the *membrana serotina*. As these membranes were discharged with the ovum at the end of pregnancy, they were called deciduous or caducous.

Fig. 66.

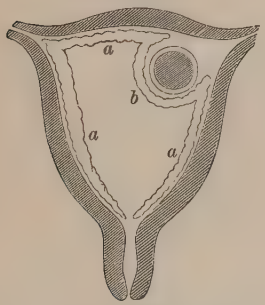
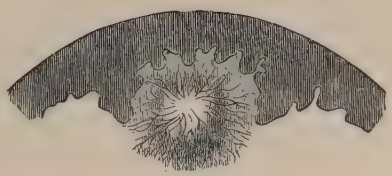


Diagram showing Hunter's Theory of the Deciduous Membranes.

a. Decidua vera. *b*. Decidua reflexa.

Fig. 67.



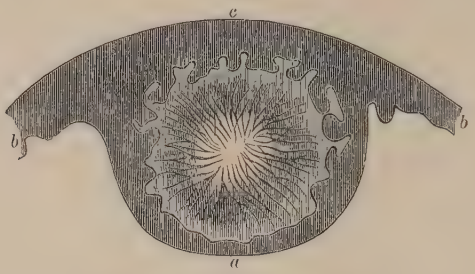
First Stage of Formation of Deciduæ.

Hunter's theory was accepted as explaining the fact that in abortion the unbroken ovum showed a complete investment from the uterine mucous membrane. While the theory has been rejected, the names of the deciduous membranes are retained, and, therefore, an explanation of the origin of these names was necessary.

The deciduous membranes originate as follows: The uterine mucous membrane is swelled and thrown into folds; the ovum is thus stopped from descent after it enters the uterine cavity, and lodges in one of the

intervals between these folds; there is formed at its place of lodgment a cup-shaped cavity, a condition which is represented in Fig. 67.

FIG. 68.

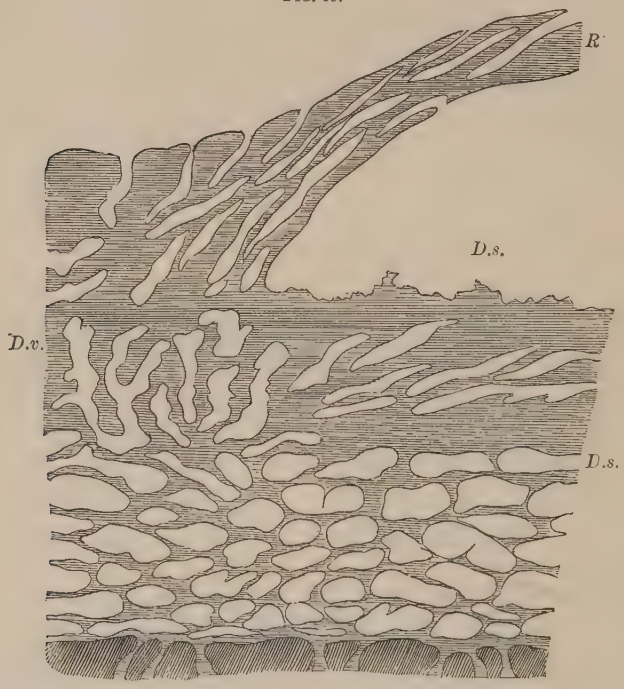


FORMATION OF DECIDUA COMPLETED.

b. Decidua vera. *a*. Decidua reflexa. *c*. Decidua serotina.

The mucous membrane upon which the ovum rests, the membrane which in the Hunterian theory was the *serotina*, is now called from its

FIG. 69.



SECTION THROUGH THE MATERNAL MEMBRANES IN THE SECOND MONTH OF PREGNANCY. × 20.

D.v. Decidua vera. *D.s.* Decidua serotina. *R.* Decidua reflexa. The ovum has been removed from its point of fixation between *R* and *D.s.*

final purpose the placental decidua. The borders of the cup-like cavity grow higher, extend toward a common centre, and finally meet and unite over the ovum, forming a complete covering; thus that which

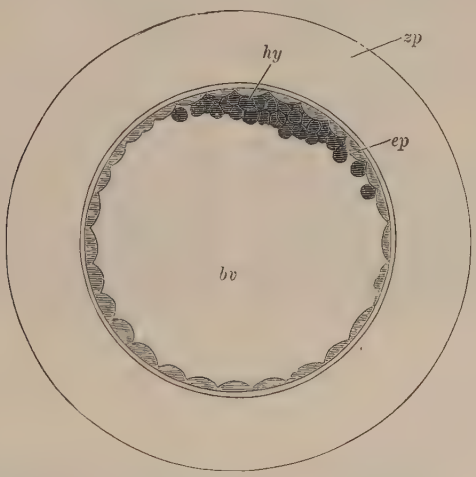
was called the decidua reflexa, but now appropriately termed the decidua of the ovule or ovular decidua, is formed.

The third deciduous membrane, *decidua vera*, covers all the internal uterine surface, including that upon which the ovum rests; it is necessarily continuous with the other membranes; it was formerly called, as has been stated, the decidua vera, but from its relation to the uterine wall it may be appropriately termed the uterine decidua.

Subsequent changes in the deciduæ will be considered in connection with the formation of the placenta and with the uterine changes caused by pregnancy, and the history of the development of the ovum will be now resumed.

The Blastodermic Vesicle. We have found the segmentation of the vitellus and the vitelline nucleus the first step in developmental changes; subsequent segmentations occurred, but these were unequal and not simultaneous, and the products were two kinds of cells differing in number, in form, in size, in arrangement, and as to transparency. The next step after the inclosure of the hypoblast by the epiblast cells is the formation of the blastodermic vesicle.

Fig. 70.

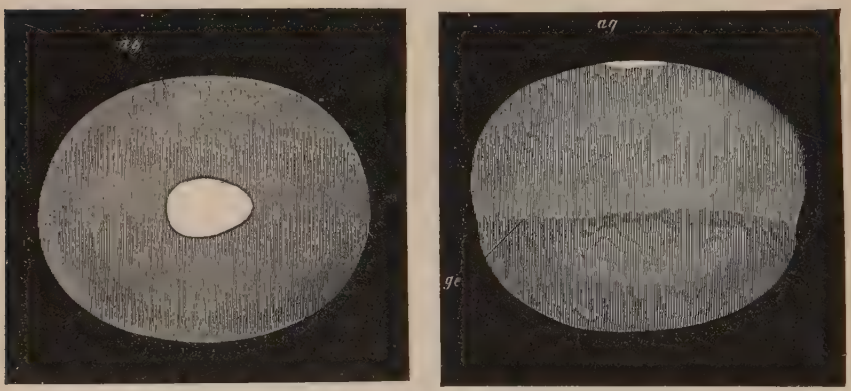


bv. Cavity of the blastodermic vesicle, or yelk sac. *ep.* Epiblast. *hy.* Primitive hypoblast. *zp.* Mucous envelope, zona pellucida. (After E. Van Beneden.)

A fissure now appears between the epiblast and hypoblast cells, and this increasing cavity separates the two at all points, except at that corresponding with the position which was occupied by the blastopore. There results a vesicle whose wall, inclosed by the vitelline membrane, is formed by epiblast cells with the hypoblast cells accumulated upon a part of its interior surface, and this is called the blastodermic vesicle, or the blastoderm. In the subjoined diagram of the rabbit's ovum, between seventy and ninety hours after impregnation, it will be seen that the vitelline membrane, membrana pellucida, is external, then the flattened epiblast cells completely line it, while the hypoblast cells are arranged in a lens-shaped mass within the epiblastic investment.

The growth of the vesicle is very rapid, and the hypoblast losing its lens-shape is flattened and extended upon the inner side of the epiblast. "The central part, however, remains thicker, and is constituted of two rows of cells, while the peripheral part, the outer boundary of which is irregular, is formed of an imperfect layer of amœboid cells, that continually spread further and further within the epiblast. The central thickening of the hypoblast forms an opaque circular spot on the blastoderm, which constitutes the commencement of the embryonic area." Next a third layer intervenes, the mesoblast, from *μέσος*, middle, and *βλαστὸς*, germ; the formation of the mesoblastic layer is not perfectly understood, but probably it originates in part from each of the primitive layers. From these layers, epiblast, hypoblast, and mesoblast, all the parts of the fœtus are formed. "In the higher vertebrates the following structures are always derived from the epiblast—namely, epidermis, epithelium of mouth, nose, and of cloaca when present; the nerve

FIG. 71.



DIAGRAMMATIC VIEWS OF BLASTODERMIC VESICLE OF A RABBIT ON THE SEVENTH DAY.

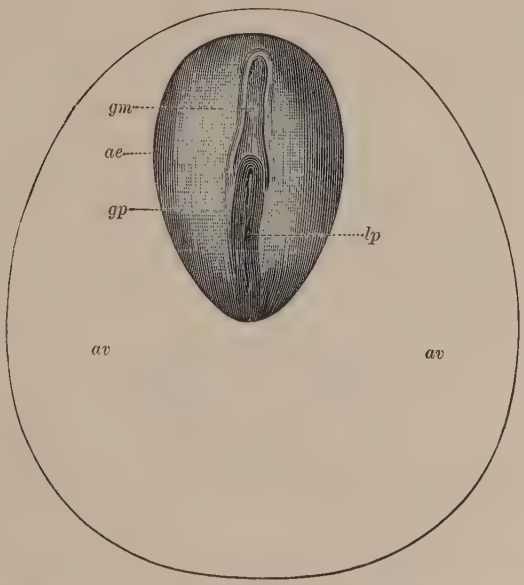
In the left-hand figure the vesicle is seen from above; in the right-hand figure from the side. The white patch (*ag*) is the germinal area; and the slight constriction (*ge*) marks the limit to which the hypoblast has extended.

cells of the brain, spinal cord, and ganglia; the neuroglia or supporting tissue of the nerve elements in the brain and spinal cord; the retina the lens of the eye; epithelium of the conjunctiva; the special sensory 'end organs' of nerve fibres in ear, nose, mouth, and skin. From the hypoblast are derived the epithelium of the digestive canal except of the buccal cavity and cloaca;" of the trachea, bronchial tubes, and air-cells; the cylindrical epithelium of the ducts of the liver, pancreas, thyroid body, and other glands of the alimentary canal. The muscles, bones, connective tissue, heart and bloodvessels, lymphatics, and the urinary and generative organs are formed from the mesoblast.

The embryonic area, *area germinativa*, becomes oval; it is composed of epiblast, hypoblast, and mesoblast. Following the pyriform appearance of the embryonic area there is found at its posterior and narrower end the primitive line or streak; a little afterward the primitive

line is seen to mark the middle of a straight, shallow groove, called the primitive groove. The next step is the formation of the axial or medullary groove upon the upper part of the embryonic area; upon each side of the groove are folds, the medullary folds, "which meet in front, but diverge behind, and enclose between them the foremost end of the primitive streak; the groove is converted into a closed tube, the neural canal, which is the beginning of the central nervous system."

FIG. 72.



SHOWING THE EMBRYONIC AREA WITH PRIMITIVE STREAK AND PRIMITIVE GROOVE OF THE OVUM (RABBIT) AT THE SEVENTH DAY.

ae. Embryonic area. *gp.* Primitive streak, or groove. *av.* Vascular area. *gm.* Medullary groove. *lp.* Primitive line.

THE EMBRYO. The embryo, from ἔμβρυος, that which grows in another's body, at first presenting form, results from a folding inward of a portion of the blastodermic vesicle, and presents somewhat the shape of a boat; the extremities, however, are unequal in size, the larger is called the cephalic or head end, while the smaller is the caudal or tail end. This infolding of the blastodermic vesicle destroys its spherical form, and a constriction divides it into two parts, the smaller of which is embryonic while the larger is called the yelk sac or the umbilical vesicle; an opening corresponding with the umbilicus offers free communication between the two.

FORMATION OF THE AMNION.[1] The development of the uterine deciduous membranes which furnish the external investment of the

[1] The term amnios was first employed by Empedocles to designate the innermost membrane covering the young, and was also subsequently applied to the fluid contained in it. Preyer believes that it was derived from ἀμενος, thin, delicate; but this became corrupted, changed into amnios, and then a false criticism made it mean "the membrane of the sheep," "the water of the sheep," as if derived from the word ἀμνὸς, a lamb.

ovum has been given, and there will be now considered the origin of the internal membrane of the embryonic sac.

At both the cephalic and the caudal end of the embryo the mesoblast is divided into a splanchnic and a somatic layer; then a fold composed of the somatic mesoblast and epiblast begins to rise up from and grow over these extremities, and also a fold from each side; the cephalic fold appears first. These double folds are the beginning of a membrane called the amnion. The caudal, cephalic, and lateral folds finally meet and unite, and thus form a complete sac. As is seen in Fig. 73, each fold is double; the inner layers form what is called the true amnion, and the outer the false. The false amnion with the epiblast from the umbilical vesicle forms the subzonal membrane.

FIG. 73.

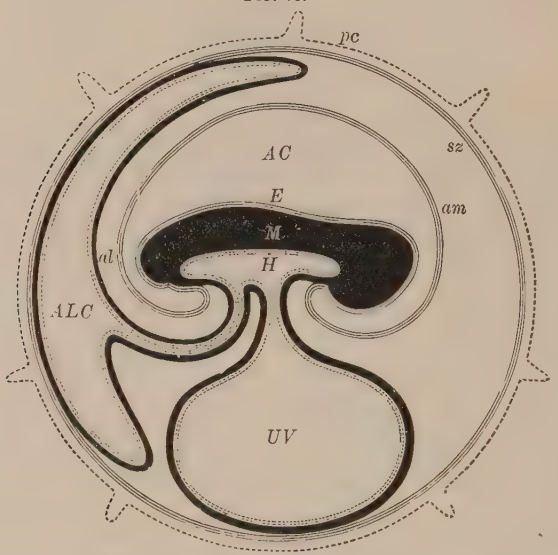


DIAGRAM OF THE FŒTAL MEMBRANES OF A MAMMAL. (STRUCTURES WHICH EITHER ARE OR HAVE BEEN AT AN EARLIER PERIOD OF DEVELOPMENT CONTINUOUS WITH EACH OTHER ARE REPRESENTED BY THE SAME CHARACTER OF SHADING.)

pc. Zona with villi. *sz.* Subzonal membrane. *E.* Epiblast of embryo. *am.* Amnion. *AC.* Amniotic cavity. *M.* Mesoblast of embryo. *H.* Hypoblast of embryo. *UV.* Umbilical vesicle. *al.* Allantois. *ALC.* Allantoic cavity.

THE ALLANTOIS. As the embryo grows and the amnion is developed, the umbilical vesicle lessens, but another vesicle is formed, the allantois or allantoid, from ἀλλᾶς, sausage, and εἶδος, likeness, because of its fancied resemblance to a sausage.

Observers differ as to the origin of the allantoid. Some claim it is derived from the terminal portion of the intestine, others from the Wolffian bodies, and still others directly from the walls of the pelvic cavity by an expansion from the mesoblast and hypoblast. Kölliker describes the allantoid in the embryo of the rabbit as appearing under the form of a hollow body in relation with the posterior intestine, lined by intestinal epithelium, and covered externally by a prolongation of the fibro-intestinal layer, and thus formed makes a projection in the free space between the amnion, the serous envelope, and the vitelline sac or umbilical vesicle.

A part of the allantoid protrudes from the embryo, and a constriction separates it from the intra-embryonic portion; the latter becomes in a later stage of development the urinary bladder, while the isthmus connecting the two is the urachus, and at birth is a fibrous cord uniting the summit of the bladder to the umbilicus. The extra-embryonic portion is at first spherical, but projecting to the subzonal membrane, it becomes flattened and spread out like an umbrella, lining the membrane throughout nearly or quite all its extent. The external layer of the allantoid is mesoblastic in its origin; this layer fuses with the subzonal membrane, and from the fusion the second of the investing membranes of the fœtus is formed. The allantoid, especially that part contributing to the formation of the chorion, becomes very vascular; the blood is brought to it by two arteries, called the allantoic, which arise from the terminal bifurcation of the aorta, and returned by one, or in some cases two veins, joining the vitelline veins from the yelk sac. The vessels of the allantoid penetrate into the chorial villi with which they are in relation. The sac of the allantoid incloses a fluid which is at first colorless, but afterward is yellow or amber-like; it is alkaline, and contains chloride of sodium, albumin, sugar, urea, and its derivatives, and a substance called allantoidine, which has in a high degree the property of converting fats into an emulsion. The chief use of the allantoid in development seems to be in conducting the allantoic, afterward the umbilical, arteries to that part of the chorion where the placenta is formed.

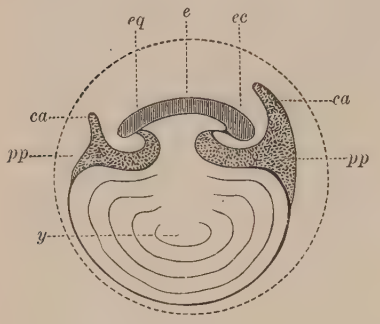
Fœtal Appendages. These are the membranes forming the sac inclosing the fœtus, consisting of the deciduæ, that of the ovum and of the uterus—the *reflexa* and the *vera*, according to John Hunter's theory—which become united so as to form a single structure, the chorion and the amnion—the placenta and the umbilical cord.

The Amnion. This is the most internal of the membranes, and forms a sac completely surrounding the fœtus. Its origin has been stated and its further development can be traced in connection with Figs. 73, 74, and 75.

In Fig. 74 the cephalic and caudal folds are seen projecting over the back of the embryo; the former fold, first in formation, is somewhat larger than the other. These folds approach very near each other, and the intervening space is so small that it is called the amniotic umbilicus. Fig. 75 shows them united. It is also seen, as previously stated, that each fold is composed of two layers, and thus the completed amnion has two walls, one internal and the other external. The former is separated throughout almost its entire extent from the fœtus by a fluid called the liquor amnii, but is continuous with it at the umbilicus; this is the permanent, or true, amnion. The external layer, or false amnion, is applied to the internal face of the vitelline membrane. The internal or true amnion covers the fœtal face of the placenta and also the umbilical cord, furnishing a complete sheath to the latter. It is thin and transparent, and is composed of two layers, the internal, which is epithelial, and the external, which is fibrous. It is without nerves, but comparatively recent investigations seem to prove the presence of bloodvessels; these are called *vasa propria*. From the middle of pregnancy the

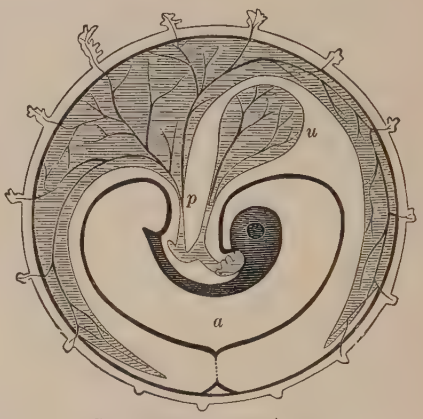
amnion is applied directly to the chorion, and united to it by a gelatinous layer of tissue, the tunica media of Bischoff; it is also called the vitriform body of Velpeau; it adheres more intimately to the amnion than it does to the chorion.

FIG. 74.



e. Embryo. *ec.* Cephalic extremity. *eq.* Caudal extremity. *ca.* Amniotic hood. *pp.* Pleuro-peritoneal cavity. *y.* Umbilical vesicle.

FIG. 75.



COMPLETION OF THE AMNION.

u. Umbilical vesicle. *p.* Pedicle of the allantoid. *a.* Amniotic cavity.

LIQUOR AMNII. The amnial liquor, Fruchtwasser, is a faintly alkaline, serous fluid, having a specific gravity of 1002–1028 (Schröder), 1002–1015 (Winckel). It is at first transparent, but later in pregnancy becomes somewhat opaque from the presence of lanugo, epidermic scales, and particles of the vernix caseosa. In the case of pregnant women who work in tobacco factories it has sometimes been found greatly discolored and having a very offensive odor; in other instances this fluid may be dark green or brown from the presence of meconium, or it may be reddish if the fœtus has been dead some time and macerated. According to Robin, it sometimes contains epithelial cells from the kidney and bladder, and leucocytes. The solid ingredients are from $\frac{1}{2}$ to 2 per cent. (Landois), 1 to 1.3 per cent. (Winckel). Among these are the chlorides of sodium, potassium, and calcium, lime and magnesium phosphates and sulphates, sodium and potassium sulphates, and sodium lactate, creatin and creatinin, albumin and mucosin, and urea. Winckel states that at first the quantity seems to be greater than the weight of the embryo: Weight of ovum, first month, 0.8 gramme; liquor amnii, 0.42 gramme. Weight of ovum, second month, 22.06 grammes; liquor amnii, 15.3 grammes.

About the middle of pregnancy the weight of the amnial liquor is equal to that of the fœtus, but from that time the weight of the latter exceeds, though the quantity of the former still increases, according to Gassner, until the end of pregnancy, then amounting to 1.87 kilogrammes, although Tarnier asserts that if the quantity exceeds a kilogramme the condition is pathological. Preyer states that there is no relation between the volume and size of the placenta and the quantity of amnial liquor, nor is there between the latter and spirals of the cord;

sheep, for example, have an abundance of the liquor, though in them the cord is scarcely if at all twisted.

Questions as to the source of the urea and the significance of the albumin in the amnial fluid will be considered in treating of the functions and nutrition of the fœtus.

Origin of the Amnial Liquor. It has been, and still is, claimed by some that this fluid is exclusively a fœtal product; but the experiments of Krukenberg first proved that an easily diffusible body readily passed from the bloodvessels of the mother into the amnial liquid without entering the fœtal blood. It is generally held, as was stated by Virchow in 1850, that in the normal state the mother as well as the fœtus takes part directly in the formation of this fluid. It has also been shown that iodide of potassium introduced into the amnial fluid may be eliminated through the mother; that in the case of the hatching egg of the bird there is an amnial fluid which must necessarily have its origin solely from the embryo, no more proves that this is the exclusive source in viviparous animals than the presence of this fluid in ectopic gestation establishes a similar truth. The skin and kidneys of the fœtus and transudation of liquid from the fœtal blood through the amnion contribute to the fluid, but its chief source[1] is the maternal bloodvessels.

Uses of the Amnial Liquor. During pregnancy the amnial liquor preserves the fœtus and the vessels of the cord and the placenta from mechanical injuries, facilitates the movements of the fœtus, and permits them to occur with less inconvenience or suffering to the mother; gives space for the development of the fœtus, prevents adhesions of amnion and fœtus, and promotes the equable enlargement of the uterus. During labor it protects the fœtus and cord from injurious pressure, and furnishes before rupture of the membranes a hydrostatic dilator for the os uteri, while after rupture the escaping fluid lubricates the genital canal. Further, this liquid contributes to the nutrition of the fœtus. Preyer[2] states that in the fœtus the tissues contain more water than the blood, and it must, therefore, get water from some other source than the blood, *i. e.*, from the amnial fluid. The fœtus swallows large quantities of amnial fluid, which is absorbed by blood and chyle vessels from the intestinal tract; in the early stages of development much amnial fluid enters through the skin of the embryo.

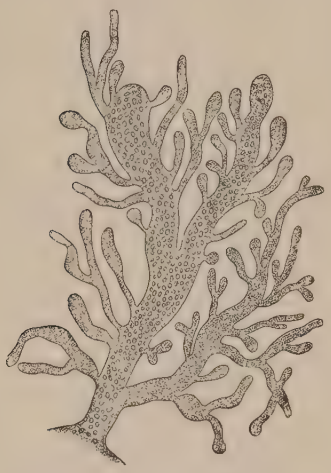
The Chorion. From *χόριον*, the membrane that incloses the fœtus in the womb. This membrane is external to the amnion, internal to the decidua. At the beginning of intra-uterine life the external covering of the ovum, the membrana pellucida, or vitelline membrane, is transparent and smooth; but in the second week its surface presents numerous projections, called villi, which are at first solid, and this is known as the primitive chorion. The permanent chorion is formed by the junction of the allantoid and subzonal membranes, followed about the fourth week by bloodvessels which begin to penetrate into the chorial

[1] This is the statement of Winckel, of Veit, and many others. Bar, however, whose thesis, Etude clinique du liquide amniotique de la femme, is quoted by Ribemont-Dessaignes and Lepage (Précis d'Obstétrique, 1893), gives only the fœtal origin. A. Martin (Lehrbuch der Geburtshülfe) says "the origin of the amnial liquor is yet in dispute; we do not know whether it is a product of the fœtus, its skin, or its kidneys, or a transudate from the mother's blood."

[2] Specielle Physiologie des Embryo.

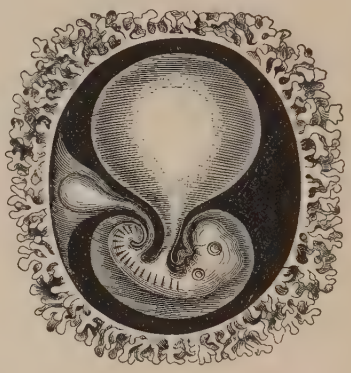
villi, and these now hollowed out become sheaths for the vessels; an artery enters each villus and supplies vessels to all its branches or bud-like offshoots; capillaries connect with veins, and the latter unite in a single trunk which returns the blood to the umbilical veins.

Fig. 76.



Compound Villus of Chorion from a Three Months' Fœtus. (Magnified 30 diameters.)

Fig. 77.



Human Embryo at the Third Week, showing Villi covering the entire Chorion. (Haeckel.)

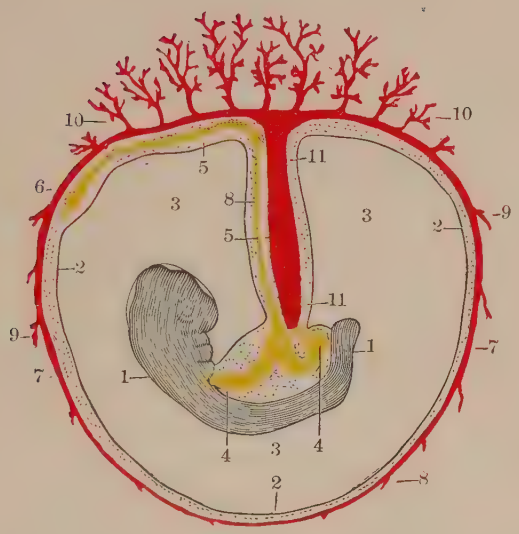
At first all the chorial villi, thus made vascular, hypertrophy, but this lasts only until the third month, when those villi in relation with the decidua of the ovum, the decidua reflexa, atrophy, while those connected with the serotine decidua, or the placental decidua, become larger and more branched; the portion of the chorion to which the former belong is sometimes spoken of as the chorion leve or the smooth chorion, while the latter is called the chorion frondosum or leafy chorion. The chorion is thicker than the amnion, but is weaker; it is composed of two layers, one chiefly of connective tissue becoming fibrous in character at the end of pregnancy, and the other of pavement-epithelium. (See Plate I.)

Doubtless the chorial villi even before they become vascular are concerned in the nutrition of the embryo, but the chief use of the chorion is in the formation of the placenta.

In the accompanying plate, exhibiting the evolution of the placenta and of the umbilical cord, the atrophy of the larger number of the chorial villi, and the hypertrophy of others, those which contribute to the formation of the placenta, are well shown.

The Placenta. This is also called the afterbirth. The name placenta, from πλακοῦς, a flat cake, was first used to designate this organ as found in the human female, by Realdus Colombos. In many of the inferior animals its form is very different from that signified by this name. The placenta in woman is a fleshy, flattened mass, usually oval, but sometimes round or reniform. Its diameter is six to eight inches, fifteen to

PLATE I.



Evolution of the Placenta and of the Umbilical Cord. (From Sappey.)

1, 1. Embryo.

2, 2, 2. Amnion.

3, 3, 3. Cavity of Amnion

4, 4. Digestive Canal.

5, 5. Pedicle of the Umbilical Vesicle.

6. Umbilical Vesicle.

7, 7. Allantoid Vesicle.

8. Pedicle of the Allantois.

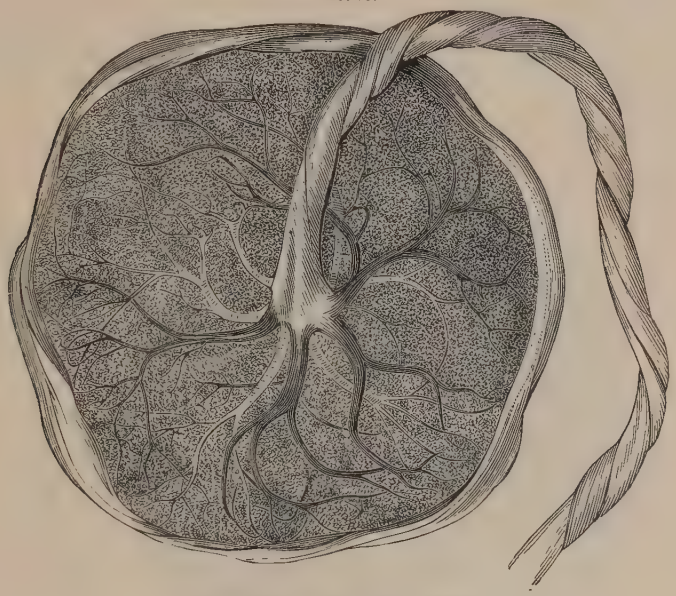
9, 9, 9. Chorial Villi beginning to atrophy.

10, 10. Villi in relation with the utero-placental decidua, which hypertrophy.

[*To face page* 128.

twenty centimetres; it is thickest at the insertion of the cord, varying from a little more than one-third to more than an inch, one to three centimetres, and thinnest at the margin, where its thickness is about one-fifth of an inch, five or six millimetres; it weighs at the end of pregnancy about eighteen ounces, or five hundred grammes. Nevertheless there is great variation in the weight of the placenta; it may be only one-half that given, or may be twice as much; usually the weight is in direct proportion to that of the child.

FIG. 78.



FŒTAL SURFACE OF THE PLACENTA.

The statement last made, as it has appeared in previous editions, having been disputed, in one of my visits to Munich I suggested to Dr. J. H. Smith, then acting as resident obstetrician in the Frauenklinik, that he should, with such ample material there available, make a new study of the question. He did so, and from the history of 500 cases of labor prepared an elaborate paper which appeared in the *Journal of Gynecology*, 1891, Toledo. The following are the most important conclusions in which we are now interested: The proportion in weight between the placenta and the child is in the thirty-third, and thirty-fourth week 1:3; in the thirty-fifth, thirty-sixth, and thirty-seventh, 1:4; thirty-eighth and thirty-ninth, 1:5. From the end of the thirty-ninth week until birth, whether it takes place in the fortieth week, or delays until the forty-fourth week, the ratio is 1:5. Dr. Smith also stated, as a result of his investigations, the placenta seems to grow in delayed labor in multiparæ or with large children, and then the average rises from 1:5 to 1:4.

Winckel states[1] that there is a close relation between the weight of the placenta and that of the child, the proportion being 1:5.5. Yet in the case of a small and diseased fœtus the placenta may be very large and heavy.

It presents two faces or surfaces, one internal or fœtal, and the other external or maternal. The external, or uterine, surface of the placenta is dark red, somewhat convex, rough and uneven. It presents irregular

[1] Lehrbuch der Geburtshülfe, second edition, 1893.

fissures, incompletely dividing the organ into lobes; these fissures are partially bridged over and lined by a whitish membrane, the remains of the placental or serotine decidua. The internal, or fœtal, surface of the placenta is smooth, slightly concave, and covered by the combined chorion and amnion, which thus form its superficial layer; the attachment of the cord and the larger divisions of its placental vessels are plainly seen. A large vein, called the circular or marginal sinus, is found at the border of the placenta. In some cases the placenta, instead of being a single mass, is composed of two parts, and is designated as placenta duplex; if composed of three parts, placenta tripartita, and if of many separated lobes, placenta multiloba; if in addition to the usual placental mass there should be one or more distinct and separate lobes, such additional placentæ are called subsidary placentæ, or *placentæ succenturiatæ.*

Fig. 79.

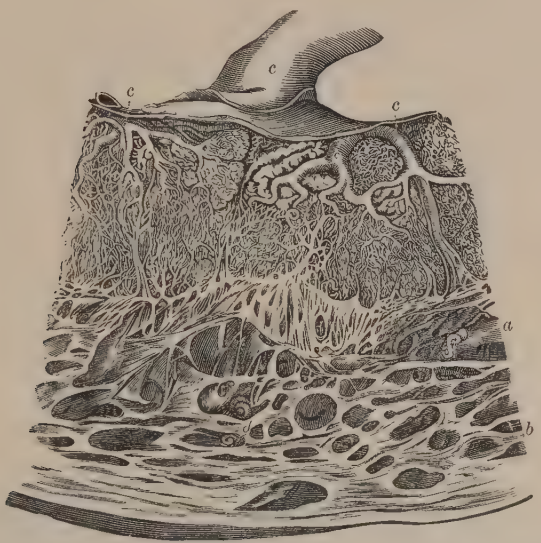
Maternal Surface of the Placenta.

Situation of the Placenta. The placenta is generally in the upper part of the uterus, upon the posterior or upon the anterior wall, in the vicinity of the opening of one of the oviducts.

J. Veit, Müller's *Handbuch der Geburtshülfe*, first volume, makes the following statement: Gusserow in 188 cases found in 77 the placenta at the anterior wall, in 93 at the posterior wall; 12 at the right, and 6 at the left; Bidder, 139 women, 73 on the posterior wall, 53 anterior, and in 8 at the fundus; while Schrader gives the situation of the placenta 37 times in front, 18 times behind, 1 directly right, 8 right and in front, 7 right and behind, and 2 left and in front.

Attachment directly to the fundus—once regarded as frequent, if not the rule—is as rare as is that to the lower part of the uterus.[1] But, as remarked by Levret, "there is not a single part of the interior of the womb where the placenta may not take root." When the attachment is in the lower uterine segment the placenta is called prævia. After the delivery of the placenta the obstetrican can, by noticing the place of rupture of the membranes, judge, approximately at least, the place which the organ occupied in the womb.

FIG. 80.



SECTION OF A PORTION OF A FULLY FORMED PLACENTA, WITH THE PART OF THE UTERUS TO WHICH IT IS ATTACHED.

a. Umbilical cord. *b, b*. Section of uterus, showing the venous sinuses. *o, o*. Branches of the umbilical vessels. *d, d*. Curling arteries of the uterus.

It is not until in the third month of pregnancy that the placenta begins to be distinct, and it is not until the end of the month that its formation is completed. Part of this organ is of maternal and part of fœtal origin, but these parts become so intimately united that they can only be separated in an early stage of its development. The placenta increases in weight until about the seventh month, when a regressive metamorphosis begins. The large villi of the chorion frondosum penetrate into the tissue of the decidua of the serotina; they do not enter the uterine glands, but into crypts formed by the hypertrophied uterine mucous membrane; the villi, at first comparatively simple in form, not only greatly increase in size, but in number; they become complex, presenting many branches and offshoots. Goodsir has compared a placental tuft to a tree, consisting of a trunk with its primary and secondary branches. Meantime the villi of the chorion not in relation

[1] Carmichael (Dublin Journal of Medical Science, 1839) having concluded, from his own examinations, that the usual site of the placenta was the lower part of the posterior uterine wall, caused so much controversy by the statement that he pleasantly remarked if he had anticipated such a result he would have left the placenta at the fundus.

with the membrana serotina atrophy, and thus the chorion leve results. The villi of the chorion frondosum are formed of connective tissue, and also, as stated by Goodsir and confirmed by subsequent observers, receive an epithelial covering from the hypertrophied serotine membrane. Each villus then is composed of connective tissue, of an epithelial covering, and of an artery and vein and connecting capillaries; this arrangement of the bloodvessels secures a closed vascular system. The placenta is composed of the hypertrophied villi of the chorion and of the serotine decidua, which grow into each other, mutually inter-penetrating, so that a single mass is formed.

After the interlocking of the chorial villi with the serotine membrane blood-spaces or sinuses are found in the maternal portion of the placenta. This results, according to some, from great dilatation of the maternal capillaries, but according to others from disappearance of the walls of the capillaries, caused by the pressure of the growing chorial villi. Into these spaces,[1] these blood-lakes, maternal arteries[2] enter, and from them veins issue. The terminal villi of the chorion float freely in the blood-sinuses, and thus the maternal is brought into such close relation with the fœtal blood that interchange of gases and nutritive materials can readily occur.

FIG. 81.

VERTICAL SECTION OF PLACENTA, SHOWING RELATIONS OF MATERNAL AND FŒTAL BLOODVESSELS.
a, a. Chorion *b, b.* Decidua. *c, c, c, c.* Orifices of uterine sinuses.

USES OF THE PLACENTA. The placenta is the organ of nutrition and of respiration for the fœtus. It was once held that there was a direct communication between the bloodvessels of the mother and the fœtus through the placenta, and thus the nutrition of the fœtus was

[1] Braxton Hicks (London Obstetrical Society's Transactions, vol. xiv.) denies the existence of placental sinuses, stating that from dissections early and late in pregnancy there is no evidence of a sinus system.

[2] Delore (Annales de Gynécologie, 1874) contends that the entrance of maternal blood into the placenta is chiefly by the placental coronary, or circular sinus, which was first described by Meckel, and which sometimes has a diameter as large as the little finger.

explained. This view is disproved by the following facts: The maternal and the fœtal circulation are not isochronous; prior to the extension of the allantoid vessels to the periphery of the ovum the embryo had a circulation; if the fœtus die in labor when the mother perishes from hemorrhage, it dies from asphyxia, not from anæmia. If the placenta be delivered with the fœtus, the circulation may continue several minutes, and there is no discharge of blood from the uterine surface of the placenta; if hemorrhage from the umbilical cord occur during labor, it does not affect the mother; the fœtal blood differs from the maternal blood in the form of the globules and in its composition. It is generally held that the interchange of gases and of nutritive elements between the maternal and the fœtal blood depends upon osmosis.[1] According to Marchal, the endosmotic processes by which nutritive juices pass from the mother to the fœtus are facilitated by the greater blood-pressure in the vessels of the former than in those of the latter. Experiments show that substances in solution may pass from the maternal to the fœtal blood. Among such substances are potassic iodide, salicylic acid, chloroform, chlorides, and turpentine. Many years ago Magendie detected the odor of camphor in the blood of the fœtus fifteen minutes after a solution of this substance had been injected into the maternal blood. Recent experiments, among others those of Dr. Pyle,[2] prove that some undissolved substances and bacteria may thus pass from the mother to the fœtus. Several other observers, both before and since Dr. Pyle's experiments, have arrived at the same results. The passage of microbes through the placenta to the fœtus is not a constant fact, and when it occurs the explanation given is that these microbes have first produced placental lesions permitting their migration.

That the placenta is the organ of respiration for the fœtus is shown by the fact that the blood going to the placenta is dark, and that returning from it light; and that the only substitute for placental is pulmonary respiration. If the umbilical circulation be arrested, the fœtus dies, and an autopsy proves the death was from asphyxia. In the placenta the fœtus exchanges carbonic acid for oxygen, just as a fish through its gills receives oxygen from the water in which it swims. Bernard has shown that the placenta has a glycogenic function in the earlier months of

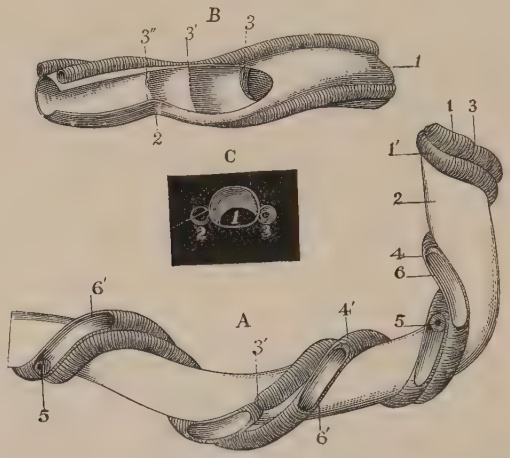
[1] Ercolani taught that the fœtal portion of the placenta is vascular, or absorbent, and the maternal is glandular, or secretory. According to his theory, the uterine juices, or milk, secreted by the epithelium of the latter, are absorbed in the chorial villi, as chyle is absorbed by the intestinal villi. Balfour has given a qualified and partial support to this view, saying: "The walls of the crypts into which the villi are fitted also become highly vascular, and a nutritive fluid passes from the maternal vessels of the placenta to the fœtal vessels by a process of diffusion; while there is probably also a secretion by the epithelial lining of the walls of the crypts, which becomes absorbed by the vessels of the fœtal villi." Goodsir stated that the function of the placenta is not only that of a lung, but also of an intestinal tube, and that the internal cells of the villi absorb the matter secreted by the external cells. Kormann (Lehrbuch der Geburtshülfe, 1884) states that the nutritive material which the fœtus finds prepared in the placenta is the so-called uterine milk. According to Hoffman (Berlin. Zeitschr. f. Geb. und Gyn., 1882), the purpose of the decidua in man as well as in animals is to furnish the necessary nourishment of the young. The decidua is a milk-secreting organ; this milk, which is secreted into the spaces which are gradually formed, and in which the placental villi are placed, here is mixed with the simultaneously extravasated blood of the mother, and thus the fœtal nourishment is formed which is absorbed by the placental villi. Landois (Manual of Human Physiology) states: "Between the villi of the placenta there is a clear fluid which contains numerous small albuminous globules, and this fluid, which is abundant in the cow, is spoken of as the uterine milk. It seems to be formed by the breaking up of the decidual cells. It has been supposed to be nutritive in function." Stirling adds, that the maternal placenta, therefore, seems to be a secretory structure, while the fœtal part has an absorbing function. The uterine milk has been analyzed by Gamgee, who found that it contained fatty, albuminous, and saline constituents, while sugar and casein were absent.

[2] Philadelphia Medical Times, June and July, 1884.

fœtal life, prior to the formation of the liver. Foster suggests that the placental glycogen is of use, not for the fœtus, but for the nutrition and growth of the placental structures.

The Umbilical Cord. The funis umbilicatus, or umbilical cord, receives its name from its twisted character. It is a cord, essentially composed of bloodvessels, connecting the fœtus and the placenta. The pedicle of the allantoid, originally a constricted portion connecting the two portions of the allantoid, one within the embryo, the other external to it, is the beginning of the umbilical cord. At first, this pedicle or stalk had two veins as well as two arteries; one of the veins, however, atrophies, so that the cord has one vein and two arteries. Hyrtl found in 6 per cent. of cases only one umbilical artery.

Fig. 82.



A. Umbilical arteries forming spirals (1, 1′) around the vein; constrictions indicating the presence of folds (5, 5′); lateral openings showing the arterial walls. *B.* Vein opened upon the side, showing a constriction (2) corresponding to an interior valve (3″); semilunar valves (3, 3′, 3″). *C.* Section of vein and arteries, showing valve of vein (1), a semilunar arterial valve (2), and a circular arterial valve (3). (Tarnier et Chantreuil.)

The formation of the cord begins at the end of the fourth week. At the middle of pregnancy its length is 5 to 8 inches, 13 to 21 centimetres, and its thickness about one-third of an inch; at the end of pregnancy its average length is about 20 inches, 50 centimetres, and its usual thickness that of a man's little finger. But the thickness may be much greater, equalling that of the thumb, or even exceeding it; if thus increased in size, it is commonly called a "fat cord," while if its diameter is notably lessened, it is called a "lean cord." The length of the cord may be reduced to two inches, or increased to five or six times the average previously given. Its surface is smooth and shining from its amniotic investment; it presents a twisted or spiral aspect; the number of spirals varies; in one case Meckel saw ninety-five: the largest number of torsions, however, occurred in a case observed by Schauta, 380. The spirals in the majority of cases turn to the left, and thus Auvard,[1] com-

[1] Op. cit.

bining the results obtained by Neugabauer, Hecker, and Tarnier with his own, found that there was sinistrotorsion in 533, dextrotorsion in 190, torsion in opposite directions in 4, and entire absence of torsion in 17, the total number being 744. The movements of the fœtus which produce torsion of the cord begin very early, for when the embryo was only one inch long the cord was somewhat twisted; according to Preyer, torsion of the cord uniformly commences in the eighth week. In most instances the vein is central, and the arteries turn round it; but in others, all three of the vessels are parallel, and turn round a fictitious axis. Why the torsions begin and are more numerous in the vicinity of the umbilicus must be obvious to anyone who watches twisting two threads by the finger and thumb at one end, the other being fixed. The torsions of the cord are caused by fœtal movements, and of course must first appear nearest the moving body.

FIG. 83.

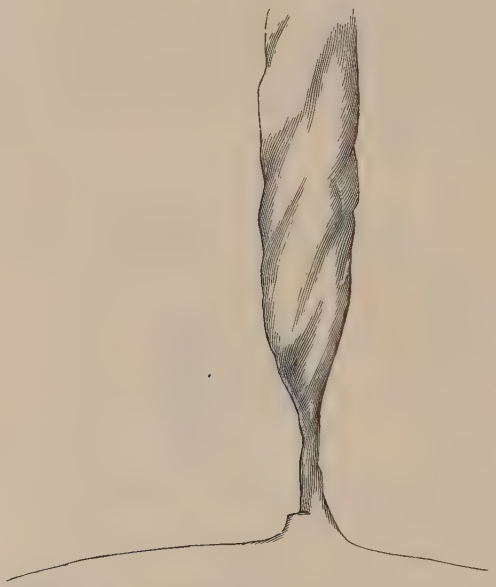
TWISTED CORD. (From SCHAUTA.)

The amnial sheath not only incloses the vein and arteries, but also a greater or less quantity of a gelatinous substance called Wharton's jelly. An unusual quantity of this material causes the cord to be very thick, and when it is tied after birth there is great liability to subsequent hemorrhage unless the tying be done very carefully so that complete constriction of the bloodvessels is secured. Wharton's jelly is a gelatinous-like connective tissue, consisting of branched corpuscles, lymphoid cells, some connective-tissue fibres, and elastic fibres. Accumulations of the jelly at particular parts of the cord, making decided prominences, cause what have been called false knots. But the absence of the jelly at a part of the cord does not prove that any of the vessels are impervious, or even that their capacity is lessened.[1] The vein has a thinner

[1] The illustration, Fig. 84, represents the appearance of the fœtal end of the umbilical cord in a large, seven months' stillborn fœtus. The fœtus was brought to me as showing intra-uterine death

wall than the arteries; the diameter of its canal is greater than that of either artery, and increases as the vessel approaches the fœtus; from the inner surface of the vein crescent-shaped folds project, occluding two-thirds of the canal. The arteries widen in the course of the cord from the fœtus to the placenta, and have projecting broad folds. The vessels have well-developed muscular walls, and hence are very contractile.

FIG. 84.



APPARENT CONSTRICTION OF BLOODVESSELS OF CORD, FROM ABSENCE OF WHARTON'S JELLY.

According to Kleinwächter, the cord has lymphatics, and Ruyl claims that he discovered nutritive capillaries in it. Winckel remarks that Valentine, Schott, and Kölliker described nerves and lymphatics in the cord, but these were not found by Virchow.

The strength of the umbilical cord varies, and in some cases very slight traction causes its rupture. Duncan and Turnbull have from experiments[1] concluded that the average weight required to break the cord is eight and one-quarter pounds; the weakest is torn by five and one-half pounds, and the strongest fifteen pounds. Pfannkuch has shown that a varicose cord has little more than half the strength of one with its vessels normal.

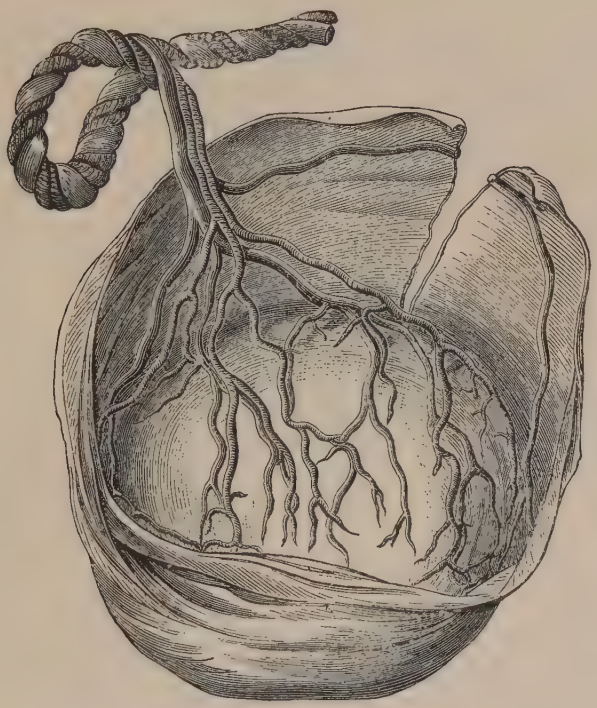
True knots are sometimes found in the cord. They have been attributed to the violent movements of the fœtus, favored by excess of liquor amnii, and to similar movements of the mother; it is altogether exceptional for knots, however numerous, to interrupt the circulation.

from obstruction of the umbilical vessels; injections, however, proved that they were not only pervious, but of normal calibre. Dr. James Young (Transactions of the Edinburgh Obstetrical Society, Edinburgh, 1870) has reported a similar case, a dead fœtus at seven months being expelled; the umbilical cord was "greatly constricted near the abdomen;" but the just test of constriction involving the bloodvessels was not made.

[1] London Obstetrical Society's Transactions, vol. xxiii.

The attachment of the cord to the placenta is usually at some point between the centre and the margin; the central insertion, though by some authorities claimed to be the rule, Naegele correctly stated is relatively rare; Levret made a similar statement. In some cases the cord is attached to the margin of the placenta, *insertio marginalis*, and the placenta is called battledore placenta; in one variety of marginal insertion the cord is attached first to the membranes and the vessels subdi-

FIG. 85.



VELAMENTOUS INSERTION OF THE CORD.

vide before entering the substance of the placenta,[1] *insertio velamentosa* (see Fig. 85). Velamentous insertion occurs in nearly one per cent. of cases. Auvard states that the insertion may be twenty centimetres from the placental margin. In some cases the vessels divide into branches before reaching the placenta, but in others they continue undivided to it. The dangers from this anomaly in labor are pressure upon the vessels, causing asphyxia of the child, or rupture when the membranes rupture, causing hemorrhage.

The insertion of the cord,[2] observed by Crédé in 443 cases, was in 109 central, in 164 excentric, in 152 near the margin of the placenta, in 8 at the margin, and in 10 velamentous.

[1] Lugol, Journ. de Méd. du Bordeaux, June, 1889, has reported a case of single pregnancy, the insertion of the cord velamentous, the placenta being double—the two parts, which were nearly equal, were three to four centimetres apart.

[2] Lehrbuch der Geburtshülfe.

CHAPTER V.

THE EMBRYO AND FŒTUS—DEVELOPMENT—ANATOMY AND PHYSIOLOGY OF THE FŒTUS—PLURAL PREGNANCY.

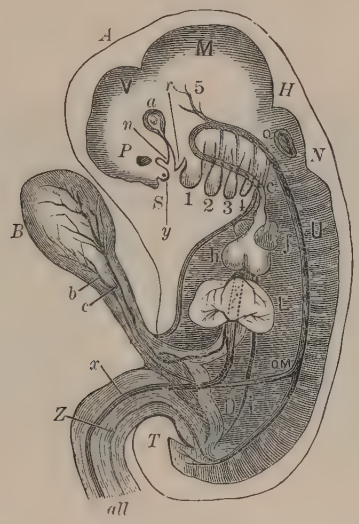
The term fœtus, a Latin word for the young of mammiferæ while in the womb, is very commonly used as a synonym for embryo, the etymological signification of which has been stated. By many, however, the product of conception in the human female is called an embryo up to three months, and after that it is known as a fœtus. This distinction between the two words is plainly arbitrary, and as far as the term embryo is concerned, is disregarded in such words as embryotomy and embryulcia. Nevertheless, as the history of the first three months differs very materially from that of the subsequent six of intra-uterine life, since by the end of three months the placenta is formed, and the new being has assumed the human form, and subsequent changes are of growth and development rather than of the beginning of organs belonging to the organism and essential for its existence or for its perpetuation, it is well to retain the arbitrary distinction between the words embryo and fœtus.

Naegele said that the obstetrician was more concerned with expedition than with fabrication—that is, with labor rather than with embryology; nevertheless, some study should be given to the latter. While, of course, embryology belongs to physiology, and is there fully presented, yet a general knowledge of the evolution of the new being from the fecundated ovule, "the dim speck of entity," belongs to obstetrics. Such knowledge is practically useful in that it enables the obstetrician to recognize how far development has progressed in a case of miscarriage; in some cases to ascertain the cause of miscarriage, whether the miscarriage be embryonic or fœtal, and also to explain the occurrence of certain deformities or so-called malformations, which are in most cases arrests of formation, failures of development. This knowledge, too, is of value in studying the physiology of the fœtus. In the following summary sketch of embryonic and fœtal development no attempt will be made to include all details and make a complete picture, but chiefly to present practical matters of interest and importance to the obstetrician.

First Month. Recalling the statement made on page 121, as to the formation of the blastodermic vesicle, its separation into two portions, one embryonic, the other non-embryonic, and the appearance in the former of the medullary groove, with a fold or plate on each side, *laminæ dorsales*, the two subsequently uniting, so that the groove is converted into a cylindrical canal—the medullary canal—it is seen that in the very beginning of organization the nervous system is placed first. The heart, at first a tubular cavity, is seen by the end of the second

week,[1] when the embryo is only one-eighteenth of an inch, two millimetres, long; by the middle of the third week it has taken an S form; and at the end of the fourth the different cavities are present and the pericardium is formed. According to Preyer,[2] it cannot be doubted that the heart commences to beat by the beginning of the third week. The visceral clefts, four in number, and arches are apparent by the twentieth day; the former are fissures found on each side of the cervical region, while the arches are thickenings of the lateral walls between the clefts.

FIG. 86.



SCHEME OF A HUMAN EMBRYO WITH THE VISCERAL ARCHES STILL PERSISTENT.

A. Amnion. *V.* Fore-brain. *M.* Mid-brain. *H.* Hind-brain. *N.* After-brain. *U.* Primitive vertebræ. *a.* Eye. *p.* Nasal pits. *S.* Frontal process. *y.* Internal nasal process. *n.* External nasal process. *r.* Superior maxillary process of the first visceral arch. 1, 2, 3, and 4. The four visceral arches, with the visceral clefts between them. *o.* Auditory vesicle. *h.* Heart, with *e*, primitive aorta, which divides into five aortic branches. *f.* Descending aorta. *om.* Omphalo-mesenteric artery. *b.* The omphalo-mesenteric arteries on the umbilical vesicle. *c.* Omphalo-mesenteric vein. *L.* Liver with arriving and departing veins. *D.* Intestine. *i.* Inferior cava *T.* Coccyx. *all.* Allantois, with *Z*, one umbilical artery; and *x*, an umbilical vein. *B.* Umbilical vesicle.

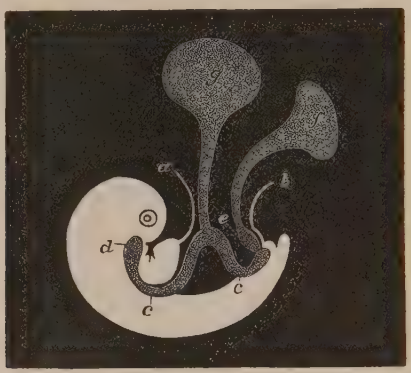
The extremities appear at the sides of the body as short unjointed stumps or projections in the third or fourth week. At the end of the fourth week the vertebral bodies and the nerve-centres are quite distinct, the thorax and abdomen make a single cavity, the diaphragm not yet having been formed, and the heart is in the upper part of this cavity. The ovum is about the size of a pigeon's egg. The embryo is a grayish curved mass, the cephalic end is much larger than the caudal, and so great is the curvature that the two approach; the length of the embryo

[1] Aristotle stated that the heart could sometimes be seen in the bird's egg as early as the third day, no bigger than a point; it is compared to a bloody spot, and its beating is mentioned; from his description the *punctum saliens* of later writers is derived. The heart is the first of organs not in formation, but in function, and in this sense is indeed *primum vivens*, though not in all cases *ultimum moriens*. Modern observers know that the heart in the chick is at the end of the first day "a small, bright-red, contracting point." Its development in mammals is much later.

[2] Op. cit.

is about half an inch, or thirteen millimetres. The primitive intestine is a straight tube, proceeding from the head to the tail, and closed at each end. It was at first a gutter, and had free communication with the vitelline sac; but the gutter is covered over, and is converted into a cylindrical canal, and the vitelline duct, inserted at that point which at a later period corresponds to the lower part of the ileum, is obliterated. In some cases the duct remains pervious a short distance from the intestine,[1] making a blind tube, the so-called "true intestinal diverticulum;" in very rare cases the duct may remain open to the umbilicus, forming a congenital fistula of the ileum, or it may give rise to cystic formations.

Fig. 87.



Formation of Alimentary Canal.

a b. Commencement of amnion. *c c.* Intestine. *f.* Allantois. *g.* Umbilical vesicle. *e.* Dotted line showing the place of the formation of the œsophagus.

Kölliker divides the primitive intestine into three segments—the buccal, middle, and terminal. From the buccal, or initial, segment all the buccal cavity as far as the glosso-palatine arches is derived; the terminal portion furnishes the lower portion of the cloaca; while all the rest of the intestinal canal and a notable part of the uro-genital system are derived from the middle segment. About the fourth week a depression upon the external tegument occurs at a point corresponding with the lower end of the terminal segment, with absorption of intervening tissue, and the anus is formed. A similar depression of the tegument occurs at a point corresponding with the position to be occupied by the mouth, and an opening is made which communicates with the buccal portion of the intestine; the mouth at first represents the space comprised between the first visceral arch and the most anterior part of the base of the cranium.

Second Month. During this month the visceral clefts completely close except the first, which becomes the external auditory meatus, the cavity of the tympanum, and the Eustachian tube. "Should any of the other clefts remain open, a condition that is sometimes hereditary in some families, a cervical fistula results, and it may be formed either

[1] Landois.

from without or within. Branchiogenic tumors and cysts depend upon the branchial arches, according to Volkmann.

The first visceral or branchial arch divides into two branches called the superior and the inferior maxillary processes; the two inferior maxillary processes, one from each side, grow toward each other, meet, and unite, making the lower margin of the mouth. So, too, the superior maxillary processes grow toward each other, but there intervenes the frontal process (*S*, Fig. 86), which unites with each of the others, and thus the upper boundary of the mouth is made, and the oral separated from the nasal opening. The separation between the nose and mouth within is made by the superior maxillary processes; from these the upper jaw, the nasal, and the intermaxillary process are produced; at the ninth week the hard palate is closed; upon it rests the septum of the nose, descending vertically from the frontal process. Different varieties of harelip result from arrest of descent of the frontal process, or from its failure to unite upon one or upon both sides with the superior maxillary processes.

It not unseldom happens, that if an infant be born with harelip, the mother attributes the deformity to her having seen while she was pregnant some one, adult or child, similarly affected. But if she saw such an object subsequent to the second month of pregnancy, it is impossible that the fœtus could have been affected through her mind, for the deformity already existed.

Cleft palate arises from the failure of those portions of the superior maxillary processes concerned in the formation of the roof of the mouth to meet and unite. As is seen, the formation of the face chiefly results from the development of the first or maxillary arches. The second arch, *hyoid*, gives rise to the stapes, the pyramidal eminences, with the stapedius muscle, the styloid process of the temporal bone, the stylo-hyoid ligament, the smaller cornu of the hyoid bone, and the glosso-palatine arch. The third arch, *thyro-hyoid*, forms the greater cornu and body of the hyoid bone and the pharyngo-palatine arch. The fourth arch gives rise to the thyroid cartilage.

In the second month the eyes appear first as two black points, one on each side of the head; the eyelids are not seen until the latter part of the month or the beginning of the next. The external ear appears as a slight projection at the seventh week. From development of the viscera the body becomes less curved. The Wolffian bodies are notably lessened in size, but meantime the kidneys and supra-renal capsules are formed. The fingers and toes appear, but they are webbed. The formation of the external sexual organs begins, as previously stated, in the sixth week, but they present the same appearance in each sex; the testicles or the ovaries appear about the seventh week. At the end of the second month the ovum is about the size of a hen's egg; the embryo measures from one inch to one inch and a half, twenty-five and a half to thirty-seven millimetres, in length, and weighs about one drachm, four grammes; the umbilical cord measures a little more than one inch, twenty-five and a half millimetres.

Third Month. The fingers and toes have lost their webbed character, and the nails begin to be developed, appearing as fine membranes.

The eyes are nearer, the ear well formed, the walls of the body are thicker and lose their transparency. The sex can be distinguished by the absence or presence of the uterus and vagina; the umbilical cord, inserted a little above the pubes, reaches a length of 2.7 inches, seven centimetres, and begins to take a spiral form. In the twelfth week the ovum is the size of a goose's egg, the embryo is from 2.7 to 3.5 inches, seven to nine centimetres long, and weighs five drachms, twenty grammes.

At about three months points of ossification are found in all parts of the vertebral column. Ossific formation begins in the cervical vertebræ, then in the dorsal, finally in the lumbar, and in all the vertebræ it begins in the bodies before it does in the arches. Hence, spina bifida, which is a hernia of the spinal membranes through a cleft in their bony canal, is rarely anterior, and it is much more frequently lumbar than dorsal or cervical.

Fourth Month. The fœtus is between six and seven inches, seventeen centimetres, long, and weighs nearly four ounces, three ounces and three-quarters, one hundred and twenty grammes; the umbilicus is above the lowest fourth of the linea alba, and the cord is seven and one-half inches, nineteen centimetres, long. The development of the female external sexual organs has been given on page 80; that of the male is the same up to a certain stage, but in the first half of the fourth month, in the male, the genital fissure closes, and the genital folds are united together to form the scrotum; the genital tubercle, which in the female forms the clitoris, becomes in the male the penis, and in the third month shows the formation of the glans. A very distinct *raphé* upon the penis and scrotum indicates the place of union of the two sides of the genital fissure. The prepuce is formed in the sixth month. The prostate, beginning in the third month as a thickening at the point where the urethra and genital cord meet, can be plainly seen in the fourth month. If the sides of the genital fissure fail to unite, the condition is known as hypospadias.

A slight down-like growth of hair, lanugo, appears on the body, and a few hairs upon the head; meconium is found in the intestine, and feeble movements of the limbs occur. A fœtus born at four months may live some hours; no respiratory movement is made, but the pulsation of the heart and that of the umbilical cord are present; Cazeaux observed an instance in which life continued four hours.

Fifth Month. At five months the fœtus is about ten inches, 25 to 27 centimetres, long, and weighs eight to nine ounces; the average is 273 grammes; the umbilical cord is about twelve inches, or 31 centimetres long. Hair on the head and lanugo distinct; vernix caseosa present. During the month, usually about its middle, the mother, in most cases, first becomes conscious of fœtal movements, and the sounds of the fœtal heart can be heard by auscultation; movements of the fœtus are felt somewhat earlier by the multigravida than by the primigravida. If the fœtus be born at five months, it breathes, cries faintly, and lives longer than when born at four months, but dies in a few hours.

Sixth Month. The fœtus is 12¼ inches, 31 centimetres, in length, and weighs a little more than one pound, 634 grammes. Its form has

become rounded by the increase of fat, lanugo covers the body and the members also, except the palms of the hands and the soles of the feet; the growth of hair upon the head is plain, and the eyebrows can be faintly seen, while the secretion from the sebaceous glands furnishes a more abundant vernix caseosa. A fœtus born at the end of six months may live from one to fifteen days. Its death occurs not only because the digestive apparatus is incompletely developed, and because the reduction of temperature is great and rapid, but because the rudimentary condition of the lungs renders respiration almost impossible,[1] for, according to Cornil, at this period of intra-uterine life air cannot distend the final pulmonary ramifications because of their anatomical structure.

Seventh Month. At the end of the month the fœtus is 13–15 inches, 33–36 centimetres, long, and weighs between 3 and 4 pounds, 1200 grammes. The eyelids are open, the testicles begin to descend in the seventh month, and are near the scrotum. The nails are almost completely formed, the insertion of the cord is about one inch and a half, four centimetres, below the middle of the length of the body. The child is said to be viable at the end of the month, but its viability is only relative to that of earlier birth; the majority of children born at this period die.

On the other hand, there are instances in which children born before the end of seven months have lived. Tarnier states that by means of the *couveuse* and *gavage* several accoucheurs have succeeded in recent years in saving infants whose intra-uterine life was only six months, or six months and some days.

A popular,[2] founded upon a professional, belief prevailed for many centuries, to the effect that a child born at seven months was more likely to live than one born at eight months. Possibly this belief is not yet quite extinct. It is, however, somewhat astonishing to find the late Dr. John W. Francis, Professor of Obstetrics in the University of New York, in his preface to the American edition of "Denman" (1821), using the following language: "The singular circumstance that a child of seven months' gestation has greater chance of living than one of eight was noticed by him," *i. e.*, Hippocrates. Now, this notion, which was held for more than two thousand years, had its origin in the infancy of obstetric science, and arose from ignorance of the essential cause of labor. It was believed that the fœtus up to seven months had its head in the upper part of the womb, but at that time the increased weight of the head caused it to fall into the lower part of the uterine cavity; the head of a boy, from its having greater size, turning downward somewhat earlier than that of a girl. But as soon as the fœtus had its head at the mouth of the womb it made an effort to get out, and, if a very strong child, succeeded. If it failed, the effort was repeated at eight months, and in case it then succeeded the fœtus, having been weakened by its previous unsuccessful attempt, had less chance of living than if birth had taken place at seven months.

Eighth Month. At the end of the eighth month the length of the fœtus is about 16 inches, a little more than 40 centimetres, and its weight is about 5 pounds, or nearly 2 kilogrammes. The insertion of the cord is about the middle of the length of the body; only one of the

[1] Pinard.

[2] As illustrative of this belief the following passage from the Memoirs of Madame Guyon is quoted. She was born in 1642, and was the founder of that peculiar form of religious belief and conduct known as Quietism: "I was born before due time, for my mother, having received a terrible fright, was delivered of me at the eighth month, at which time they say it is almost impossible for a baby to live."

testicles, usually the left, is in the scrotum; during the month the body increases less in length than in breadth.

Ninth Month. The length of the fœtus at term varies from about 19½ inches to a little more than 22 inches, 50–56 centimetres; its weight by many is placed as between six and seven pounds: Landois, however, makes it seven pounds, 8¼ kilos. The last statement corresponds more nearly with that resulting from statistics, including 500 male and 500 female children, taken from the obstetric records of the Philadelphia Hospital.[1] These statistics showed the average weight of female children to be seven pounds one ounce and a half, and that of male children to be seven pounds eight ounces. In only one of a thousand was the weight eleven pounds.

Burns regarded the weight-proportion between the sexes in the newborn to be such that twelve males would weigh as much as thirteen females. The late Sir James Simpson has drawn attention to the fact that from the great size of the head of the male the fœtal mortality in childbirth was larger with male than with female children; Bertillon's statistics prove that the fœtal mortality in birth is in the proportion of 130 males to 100 females. If a child's weight at birth be decidedly under the average,[2] the probability is that the labor is premature, or else the normal development of the child has been interfered with. So, too, if the weight be much above the average, it is possible that in some cases the pregnancy has been protracted beyond the normal time.

In one instance in my practice a child was born weighing only one pound and a half, the pregnancy ending a few days before the completion of the seventh month; the child lived, and is now a healthy boy of ten years.[3]

Dr. R. P. Harris, in a note to "Playfair," states: "We have had children born in this city, Philadelphia, at maturity that weighed but one pound. The well-remembered 'Pincus' baby weighed a pound and an ounce."

In some instances children weighing twelve pounds and even more have been born. But it is remarkable that most of the cases of birth of unusually large children occur in private, not in hospital practice. Pinard, from an examination of the records of the Paris University, found but one in 20,000 that weighed 5300 grammes, a little more than twelve pounds.

Nevertheless children have been born whose weight was very much greater than even this. For example, Dr. Adye, of Bentonville, Ind., in a recent letter to me states that in his practice a woman was delivered spontaneously and rapidly of a child weighing 16 pounds; both mother and child did well. The most extraordinary case that has been communicated to me, however, was one occurring in the practice of Dr. Josiah Peltz, of this city. On the 29th of

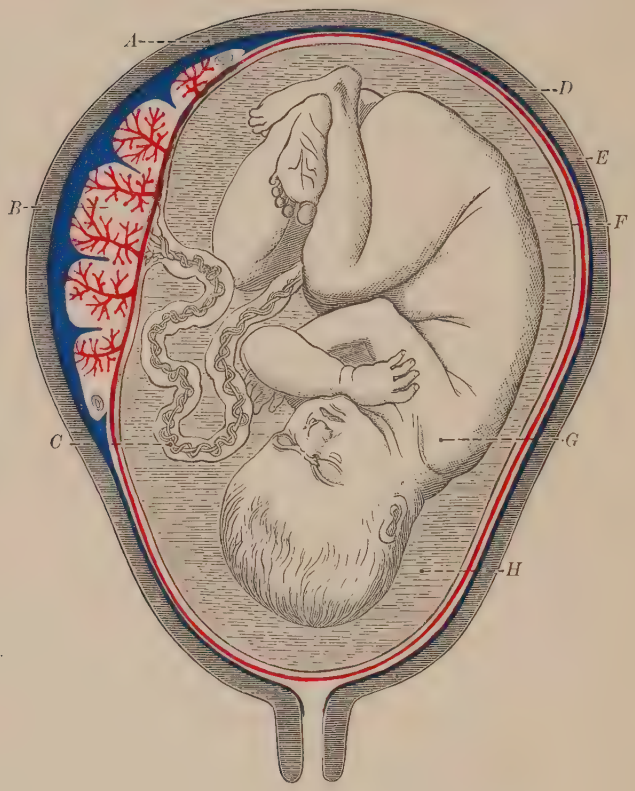
[1] I am indebted to Dr. R. J. Phillips, one of the internes at the time, for preparing these statistics. A curious fact which I have observed in my hospital service is, that there is less difference in weight between the sexes of the newborn in the black than in the white. While a sufficient number of observations have not been made to establish a law, there are *a priori* reasons for believing in its possibility.

[2] Kormann, op. cit., believes that pregnancy may last at least two or three weeks beyond two hundred and eighty days, and that then the fœtus may be developed beyond the average, so that its weight is 6000 grammes, and its length 30 centimetres. This subject will be referred to again in connection with the topic of prolonged pregnancy.

[3] Gilbert (Zeitschrift für Geburtshülfe und Gynäkologie, Band 16, Heft 1) reports the case of a female child, born in the twenty-ninth week of gestation, weighing three and a half pounds; the child was twenty-two inches long when five and a half months old. Various incubators were tried, but daily warm baths were most successful. The child was taken into the open air from the moment of birth. For the first week a wet-nurse fed the infant; afterward the mother. From the seventeenth day it was fed breast-milk with a spoon. When eighteen weeks old cow's milk was given.

In growth the greatest gain occurred at the time when birth would have normally occurred. The child suffered from frequent attacks of syncope until its fourth year; it had also spinal curvature (scoliosis 35°) from rhachitis; this was afterward reduced by orthopedic treatment (to 5°). The milk teeth were complete at three and a half years.

PLATE II.



THE MATURE OVUM. (After Runge.)

A. Uterine wall.
B. Placenta.
C. Umbilical cord.
D. Decidua.
E. Chorion.
F. Amnion.
G. Fœtus.
H. Amnial liquor.

[*To face page* 145.

October, 1887, he delivered Mrs. S., at the end of her fourth pregnancy, of a female child weighing 22 pounds. The child was stillborn, but the doctor believes that it could have been resuscitated had proper means been used; the means were not used because for some time his sole care was of the mother, who had dangerous uterine hemorrhage. Dr. Peltz states that his patient is a woman of unusual size, ordinarily weighing 225 pounds, and that her pelvis is remarkably large.

My friend Dr. T. G. Davis, of Bridgeton, N. J., informs me that Dr. J. R. Thompson, of that city, delivered, with forceps, a woman of a dead child which weighed 21 pounds.

Harris, op. cit., says: "Probably the largest fœtus on record was that of Mrs. Captain Bates, the Novia Scotia giantess, a woman of 7 feet 9 inches in height, whose husband is also of gigantic build, reaching 7 feet 7 inches in height. This child, born in Ohio, was their second, and was lost in its birth, as no forceps of sufficient size to grasp the head could be procured. The fœtus weighed twenty-eight and three-fourths pounds, and was thirty-nine inches in length. Their first infant weighed nineteen pounds."

Considering the pregnancy as lasting ten lunar months, the following is the length of the embryo or fœtus at the end of each month, as stated by Haase:

| | | |

tion, and they are mobile, because instead of being united together by bone, their union is by fibrous tissue. Further, in the fœtal head mobility of the squamous portion of the occipital results, as pointed out by Budin,[1] from its being united to the basilar portion by cartilage, which serves as a hinge, and the former is moved forward or backward according to the action of external force.

Sutures and Fontanelles. The membranous spaces between the bones of the head are called sutures and fontanelles. The sutures are straight or curved lines, and the fontanelles are at the junction or at the intersection of sutures; if at the former, the fontanelle is triangular, but if at the latter, quadrangular. The three most important sutures are the sagittal, the fronto-parietal, and the occipito-parietal. The sagittal—from *sagitta* an arrow, meeting the bowstring at a right angle, passing directly over the bend of the bow, and thus intersecting the middle of the arc described by the fronto-parietal suture—is the longest, and extends from the root of the nose to the upper point or

Fig. 88.

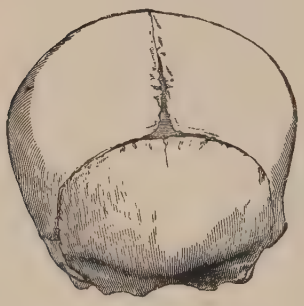
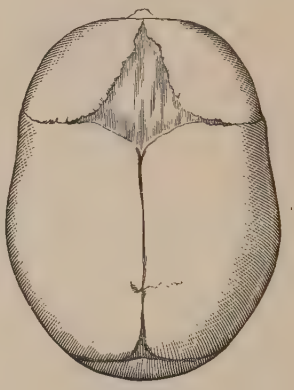


Fig. 89.



Anterior and Posterior Fontanelles, Sagittal and Occipito-parietal and Occipito-frontal Sutures.

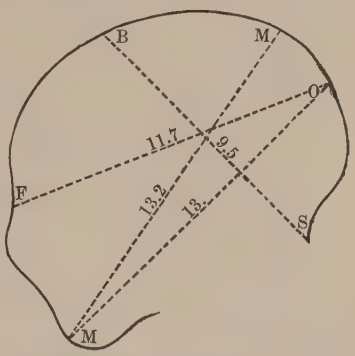
angle of the occipital bone; it is the dividing-line between the two halves of the frontal bone and between the two parietal bones. The fronto-parietal, as its name indicates, is between the frontal and the parietal bones; it ends on either side at the squamous portion of the temporal bone. The occipito-parietal, usually called lambdoidal from its suggested resemblance to the Greek[2] letter lambda, λ, is between the occipital and parietal bones; it may be described as a bifurcation of the sagittal suture.

The chief fontanelles are two, one anterior, the other posterior. The former, also called bregma, from βρέχω to moisten, because of its being so yielding to the touch, is at the intersection of the two sutures, the sagittal and the fronto-parietal, and therefore quadrangular. It is a large, membranous depressed surface, with unequal sides, the two ante-

[1] De la Tête du Fœtus au point de vue de l'Obstétrique.
[2] Its resemblance is greater, as Bailly has said, to a capital V, whose angle corresponds to the end of the sagittal suture.

rior being longer than the two posterior; these features are so characteristic that its recognition in labor by the touching-finger is usually quite easy. The posterior fontanelle is at the junction of the sagittal with the occipito-parietal suture, it is consequently triangular; it is quite small, and in labor cannot, as a rule, be recognized as a membranous space, for in consequence of the movement of the squamous portion of the occipital bone forward, the overriding parietal bones hide it from touch; but its position may be recognized by its corresponding with the point of apparent bifurcation of the sagittal suture, and by its being at the apex of a depressed triangle, two of the converging sides of the triangle being the posterior margin of each parietal bone, and the intervening space occupied by the occipital bone.

FIG. 90.



ANTERO-POSTERIOR DIAMETERS OF FŒTAL HEAD.

Lateral and supplementary fontanelles are also to be noticed. The chief of the former are at the junction of the occipito-parietal and temporal sutures, but they are concealed by soft parts. Supplementary fontanelles are membranous spaces arising from failure of ossification; they are sometimes found in the middle of a bone, sometimes in the course of a suture; remembering these facts as to their position, one is not liable to confound them with either of the fontanelles that have been described, and which are such important guides in practical obstetrics.

DIAMETERS OF THE FŒTAL HEAD. These are lines drawn between certain points of the fœtal head. Following the example of Budin, these diameters may be classified according to their general direction, as antero-posterior, transverse, and vertical. The antero-posterior are four, viz., the maximum, the occipito-mental, the occipito-frontal, and the suboccipito-bregmatic.

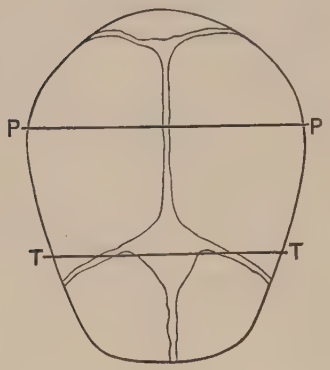
The maximum diameter extends from the chin to a variable point, which is in almost every case situated in the sagittal suture between the two fontanelles. The occipito-mental diameter reaches from the point or angle of the occiput to the chin. The occipito-frontal is between the angle of the occiput and the root of the nose, and the suboccipito-bregmatic is from the point of meeting of the occipital bone with the nucha to the middle of the anterior fontanelle, that is, where the sagittal and fronto-parietal sutures cross each other.

The transverse diameters are three, viz., the biparietal, between the parietal protuberances, the bitemporal, between the origin of the fronto-parietal suture on each side, and the bimastoid, which extends between the mastoid apophyses.

The vertical diameters are two, the fronto-mental, extending between the highest point of the forehead and the chin, and the trachelo-bregmatic, from the middle of the anterior fontanelle to the upper and

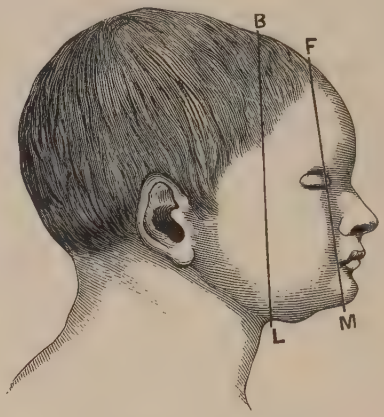
anterior part of the neck in the immediate vicinity of the larynx. This diameter is also called the cervico-bregmatic and the laryngo-bregmatic.

Fig. 91.



Biparietal and Bitemporal Diameters of Fœtal Head.

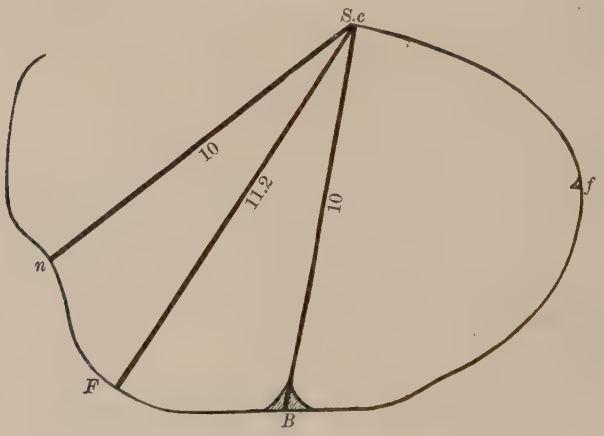
Fig. 92.



Vertical Diameters.

The illustration which follows, taken from Tarnier, shows the three diameters, suboccipito-bregmatic, suboccipito-frontal, and suboccipito-nasal, as measured in an infant immediately after delivery. The fact of the second diameter being greater than either of the others, and hence the circumference of the child's head corresponding with it will be that which will be with the greatest difficulty forced through the

Fig. 93.



The Three Suboccipital Diameters.

vulval ring, are apparent. The importance of this diameter in regard to expulsion of the head, that is, the greater danger to the perineum at the time its circumference passes, has been in recent years especially

urged by Matthews Duncan and by Ribemont. But long before them Smellie and Burton had referred to the essential fact.

The greatest circumference of the fœtal head is that corresponding with the maximum diameter, and the least that which is similarly related to the suboccipito-bregmatic.

In the following table of diameters and circumferences the measurements given by Tarnier and Chantreuil are presented. Each metric measurement is followed by its equivalent in inches and hundredths, and this in turn by an approximative measurement, where it seemed most convenient for remembering, substituting vulgar for decimal fractions.

Maximum diameter	13.5 cm.	5.31 inches or	5¼
Occipito-mental	13. "	5.11 "	5⅛
Occipito-frontal	12. "	4.72 "	4¾
Suboccipito-bregmatic	9.5 "	3.75 "	3¾
Biparietal	9.5 "	3.75 "	3¾
Bimastoid	7.5 "	2.75 "	2¾
Fronto-mental	8. "	3.15 "	
Bitemporal	8. "	3.15 "	
Trachelo-bregmatic	9.5 "	3.75 "	3¾
Great circumference	37. "	14.57 "	14½
Small circumference	32.5 "	12.80 "	12⅞

Upon comparing these diameters of the fœtal head with those of the maternal pelvis, it will be seen that only two of the former exceed the greatest of the latter; but in normal labor neither of the two is brought in relation with a pelvic diameter.

Modification of Diameters of Fœtal Head in Labor. Budin has shown that certain modifications in the diameters of the fœtal head are produced by the overriding of bones at the sutures, from the pressure upon the head in passing through the pelvis, and that by these changes the head is changed in shape, the change varying with the position. In general the alterations in the diameters are as follows: the occipito-mental and occipito-frontal diameters are lessened; the maximum diameter is increased; the suboccipito-bregmatic and the bitemporal are lessened; the biparietal is very slightly lessened; but the mastoid not changed.

Movements of the Fœtal Head. The head may be bent forward or backward so as to come in contact with the body; the first is called complete flexion, and the second complete extension; this movement takes place chiefly in the articulations of the cervical vertebræ, the occipito-atlantoid articulation participating only very slightly. The last articulation, however, permits rotation of the head to the right or to the left through a quarter of a circle. Tarnier, in reply to the question whether the head can be made to rotate much more extensively without injury to the cord or to the ligaments, asserts that the fears expressed are purely theoretical, and that a movement of rotation so extensive that the face is turned directly backward may be made without producing any lesion. This topic will be again referred to.

Diameters of the Trunk. The bis-acromial diameter from one acromion to the other is the longest trunk diameter. It is 4.7 inches, or 12 centimetres; it can be reduced one inch, or to 9.5 centimetres. The dorso-sternal is 3.7 inches, 9.5 centimetres. The bis-trochanteric diameter is 3.5 inches, 9 centimetres. The sacro-pubic diameter is a little more than 2 inches, 5.5 centimetres; by the flexion of the thighs upon

the abdomen and the legs upon the thighs this diameter is nearly doubled, but compression readily lessens it. All the trunk diameters lessen by compression more than do those of the head.

Increase in Weight and Length of Fœtus in Successive Pregnancies. As a matter that is of great practical importance in some cases in reference to obstetric treatment, it may be stated that from the weight and length of the child of the immediately previous birth those of the next can be determined. The increase in weight is, on the average, 150 grammes, and in length 0.75 centimetre. Suppose that in the first labor the child has the average weight and length, the following table shows approximately those of children born subsequently; it has been taken from Ahlfeld:

The second child's weight will be				3400 gr.,	its length	51.75	cm.
The third	"	"	"	3550 gr.,	"	52.50	"
The fourth	"	"	"	3600 gr.,	"	53.25	"
The fifth	"	"	"	3750 gr.,	"	54.50	"

Attitude of the Fœtus in the Womb. By this are meant the general form and direction of the trunk, and the position of the limbs with reference to it. We have seen that in the very dawn of development the first distinct form which the embryo had was that of a curve, the ends of that curve tending to approach; and the curved form is kept through all intra-uterine life. As shown in the above diagram of the fœtus contained in the uterine cavity, the back is bent forward, the chin inclined to the chest, the arms folded over the breast, the feet flexed, the legs flexed upon the thighs, and the thighs upon the abdomen; the fœtus is thus folded upon itself, making an ovoid, its position being not unlike that of a chrysalis in the cocoon, or a chick in the shell. Harvey's explanation of the attitude of the fœtus was this: "The truth is, that all animals, whilst they are at rest or asleep, fold up their limbs in such a way as to form an oval or globular figure; so in like manner embryos, passing as they do the greater part of their time in sleep, dispose their limbs in the position in which they are found, as being most natural and best adapted for their state of rest." Cazeaux regarded the attitude of the fœtus as representing "a constrained position, which could not have been produced by the mere pressure of the uterine walls upon the child, since the latter is in a cavity much larger than its whole volume; hence it must be referred to the individual itself."

Fig. 94.

Posture of the Fœtus.

As has already been stated, the attitude of the fœtus is the perpetuation of that of the embryo, and the primitive form of the latter must be regarded as one of the factors in causing it. But others are also concerned—indeed, by some made the exclusive factors; Pinard, for

example, saying[1] that the causes are material, extrinsic, and belong to the pressure-forces much more than to the individual—and these will be considered under the next topic.

Presentation of the Fœtus. By presentation is meant that part of the fœtus which is in relation with the pelvic inlet, and in labor first descends into the pelvic cavity; that part, in a word, which *presents* at the inlet and in the cavity. In about ninety-six per cent. of cases of labor at term the head presents; many obstetric authorities indeed regard this as the only normal presentation, as it is certainly the most favorable. Various explanations have been given of the fact.

The Hippocratic theory held that the fœtus was attached by ligaments passing from the umbilicus to the fundus of the womb, its head being above; rupture of the ligaments occurred at seven months, and then the child immediately turned its head down and attempted to force its way out of the womb. Aristotle held with Hippocrates as to the original position of the child, but added gravity in explaining the turning downward of the head. Trentius, 1564, found in the form of the uterus the reason for the head usually being in its lower portion at labor. The illustrious Paré attributed the presentation to instinct. Dubois sustained this hypothesis, illustrating it by instinctive acts of the newborn seeking the nipple and sucking. Sir James Simpson held that reflex action was not the exclusive but the ancillary cause, using the following language:[2] "At and toward the full term of utero-gestation the position of the fœtus with its head lowest is thus greatly maintained by the relative *physical* adaptation of the ovoid shape of the rolled-up mass of the fœtus to the ovoid shape of the cavity of the uterus. But this particular adaptation and position of the fœtus would be often lost if no other additional and *vital* means were in operation, as we see, indeed, often happens when the child dies. The other additional means, by whose influence this special position is still further rigorously and carefully sustained, consists of the restoring influence of reflex motions on the part of the fœtus itself."

The gravitation theory proposed originally, as we have seen, by Aristotle, is advocated by some to-day as an assisting, by others as the chief cause, notwithstanding the experiments of Dubois and the criticisms of Simpson, which appear conclusively to disprove it.

One of the most curious of modern hypotheses, mentioned by Cohnstein[3] in his paper upon "Normal Presentation of the Fœtus," is that of Pröbsting. The head presents because of the efforts of nature to place the orifice of the respiratory organs of the fœtus as near as possible to atmospheric air.

Cohnstein denies that the cause of presentation of the head is in the movements of the fœtus, or in forces external to it, but asserts that it is in the fœtal circulation, for until seven months a larger amount is sent to the upper part of the body, but then the amount of blood is equalized.

For Pinard one law governs the relations between the fœtal and the maternal organism, and this law is absolutely the same as the law of

[1] Dictionnaire Encyclopédique des Sciences Médicales.
[2] Obstetric Works.
[3] Archives Générales de Médecine, 1869 and 1870.

accommodation of labor so well formulated by Professor Pajot: *When a solid body is contained in another, if the container is the seat of alternate movement and rest, if the surfaces are slippery and little angular, the content constantly tends to accommodate its form and dimensions to the form and capacity of the container.*

While this law explains the presentation of the head of the fœtus better than the gravitation theory, or that of instinctive or reflex fœtal movements, it seems probable that it is not the sole cause of the attitude of the fœtus, but merely assists the action of the primitive cause.

Studying Pajot's law, as it relates to presentation alone, we find in the painless contractions of the uterus in pregnancy, in the varying abdominal pressure, and the changes of position of the mother, which have more or less action upon the fœtus, the conditions of movement and rest; the fœtus presents more of a rounded than of an angular surface, and after the secretion of the sebaceous glands begins this surface is smooth, slippery, and thus, the amnial liquor assisting, the accommodation of the content to the container is effected. This accommodation fails in those months of pregnancy when the uterus is very much larger than the fœtus. Thus Veit's statistics show that in 247 deliveries between the first of the fifth and the sixth month the head presented in 140, the pelvis in 95, and the trunk in 12. If the fœtus be dead and macerated, one of the conditions of the law fails, the content is no longer a solid body, and statistics show that in very nearly one-half of the cases in which delivery takes place before six months the pelvis presents.

As pointed out by Sir James Simpson, presentation of the pelvis is common if the child be hydrocephalic; here it is evident that accommodation causes the presentation. In twin pregnancies accommodation is difficult, and Kleinwachter's statistics show presentation of the head in 69 per cent., of the pelvis in 25 per cent., and of the shoulder in 5 per cent. In polyhydramnios the fœtus is usually small, and thus ample space doubly secured interferes with accommodation, so that malpresentations are common.

Pinard[1] attaches great importance to the action of the abdominal wall in assisting in accommodation; its elasticity and the contraction of its muscles prevent the uterus from departing from the median line—press it at all points, especially upon the sides. He attributes the greater frequency of malpresentations in multiparæ, seven to one in primiparæ, to the relaxation of the abdominal muscles caused by preceding pregnancies. So, also, he assigns to the same cause the frequent changes of position of the fœtus in pregnancy and the delay in the engagement of the presenting part in the latter weeks. Nevertheless, while admitting the force of these arguments, much must also be ascribed, as held by Charpentier, to the greater relaxation of the multiparous than of the primiparous womb, and its larger cavity as accounting, in part at least, for these results.

Pinard divides the causes into active and passive. The latter are the forms of the uterus and of the fœtus in the different periods of

[1] Op. cit.

pregnancy, the folding together of the fœtal body and limbs, the gliding surface of the fœtus, and the amnial liquor. The active causes are the contractions of the uterus, the painless contractions of pregnancy, and the contractions and tonicity of the muscles of the abdominal wall.

Winckel concludes that the position and attitude of the child are determined principally by the shape and activity of the uterus, aided by the shape and movements of the parts of the fœtus, and that the predominance of cephalic presentations results from the direction of uterine force, the greater size of the upper than of the lower segment of the uterus, the greater mobility of the child's head, and the shape of the uterus and child, the latter being better adapted to the former when the head presents.

It must be obvious that the most important part of this explanation is that which rests upon Pajot's law, previously stated.

Dr. D. T. Smith, of Louisville, Ky., some time since[1] gave an original explanation of the cause of presentation of the head, and has recently repeated it:[2] "Whoever has practised diving in deep water has discovered that if he holds his arms in such a way as not to hinder his progress—folded at his back or breast, for instance, or pressed to his sides—and then kicks out with his feet he will go directly to the bottom. Now the position of the child in the uterus, and the course of its development, are such that it makes essentially similar movements. The flaccid state of the walls of the uterus allows them to yield when pressed against by the lower limbs, and in this way the fœtus gains the advantage that would accrue to it from swimming in a larger mass of water than that contained in the uterus. Adding to the influence of these movements the increasing conicity of the lower segment of the uterus that develops during the latter months of pregnancy, we can easily account for the greater preponderance of head presentations. In every position the mother takes, except that of lying on the side, the outlet of the uterus is lower than the fundus, and in all except the latter the movements the child spontaneously makes will tend to place its head downward."

Dr. Smith has more recently presented his views in a valuable monograph entitled *Obstetric Problems*, 1892.

Foulis[3] concludes from the study of sections through the pelvis and abdomen that the continual movements of the child's lower limbs in extension cause the head-downward position. The prevalence of the situation of the occiput and back on the mother's left side results from the proportionally large size of the liver in the pregnant woman, which fits over the uterus like a cap, affording firm resistance to the impact of the child's feet.

Physiology of the Fœtus. The chief fœtal functions are nutrition, circulation, respiration, secretion, innervation, and motility.

Nutrition. It is supposed that the nutrition of the impregnated ovule is at first by the granular matter, the discus proligerus, which surrounds it when it escapes from the ovisac. In some of the inferior animals the ovule, during its passage through the oviduct, receives a covering of albumin, and probably the same fact exists in the human ovule; if so, this albuminous coat may nourish it. After entering the womb the primitive chorial villi absorb nutritive material from the uterus; the granular contents of the umbilical vesicle probably nourish the embryo, but as the vesicle is atrophied at the end of the fifth week, this supply lasts but a short time.

The question as to the amnial liquor contributing to the nourishment of the fœtus—that it is the sole or chief supply no one now holds—is

[1] American Practitioner and News, 1887.
[2] American Journal of Obstetrics, 1890.
[3] Edinburgh Medical Journal, September and October, 1888.

still in dispute. According to Fehling, the human embryo has at the sixth week 97.54 per cent. of water; in the fourth month the quantity of water of the fœtus is between 88 and 93; in the fifth, between 88 and 93; in the sixth, between 83 and 90; in the seventh, between 82 and 85; and in the mature fœtus born dead, 74.1. Bischoff, however, found in the newborn only 66.4 per cent. of water. Preyer's statements as to the fœtus obtaining water from the amnial liquor by swallowing, and by absorption through the skin, have been given on page 127. Further, while the percentage of albumin in the amnial liquor is very small, the absolute quantity the fœtus obtains may be very great by accumulation; this liquor contains salts, sodium and calcium phosphates, which are important for the development of the fœtus.

Ahlfeld[1] concludes from the examination of the meconium that the fœtus swallows considerable quantities of the amnial fluid. This is a physiological process; he has found the amnial fluid albuminous in several cases, ranging from twenty to fifty per cent. albumin. His tests were nitric acid and heat.

He believes that the albumin of the amnial fluid is nutriment for the fœtus, and by an elastic bag applied over the mother's abdomen at the location of the child's back, he demonstrated movements of the child's thorax in the uterus, which he considered those of deglutition.

Mekus[2] has met with an instance supporting the belief that the fœtus swallows the liquor amnii, in the case of a child who could not retain fluid swallowed; it died of inanition, and was poorly developed at birth. On examination, the œsophagus was impervious at its middle. It was noticeable that the liquor amnii was very abundant at birth. The case is virtually a ligation of the œsophagus in the living fœtus; result, a poorly developed and nourished fœtus, no evidence of liquor amnii in the digestive tract, and an abnormal abundance in utero.

Undoubtedly, materials present in the amnial liquor have been found in the stomach and intestines of the fœtus, and thus it is proved this liquor may be swallowed, but it is not proved that this is the rule, and up to the present most have regarded it as the exception. Moreover, monsters in which the mouth is absent are born well developed, and therefore the entrance of amnial liquor into the alimentary canal is not essential to nutrition. Further, as pleasantly remarked by Pinard, the same physiologists who assert the nutrition of the fœtus by the amnial liquor, also hold that the fœtus passes urine into this liquor, and it is singular if such a fluid contributes to its nourishment.[3]

The permanent and certainly the chief, if not the only, nutritive supply of the fœtus is secured through the placenta—other means are only temporary or secondary; during the formation of this organ chorial villi, especially those which contribute to its structure, the chorion frondosum, supply nutritive material to the embryo. The growth of the new being is much slower before than after the development of the

[1] Zeitschrift für Geburtshülfe, Band 14, Heft 2.

[2] Centralblatt für Gynäkologie, No. 42, 1888.

[3] Preyer, *op. cit.*, admits the fact, remarking: However parodoxical it may appear, the fœtus discharges urine into the amnion, and drinks it, with the other constituents of the amnial fluid, in quantity so much greater as the term of gestation approaches, like the embryo of the bird before hatching.

Dührsenn, Centralb. f. Gynäkol., 1888, concludes from his investigations that in the latter part of the intra-uterine life the organs of the fœtus function as in extra-uterine life; and that the urine of the fœtus from time to time is emptied into the amnial fluid. He believes the nutrition of the fœtus is dependent solely upon the placenta, and that amnial liquor is produced by fœtal excretion.

placenta, the fœtus increasing in weight during the last six weeks of pregnancy to an amount equal to that which it attained in the first five months. Fœtal nutrition has been compared to that of a vegetable parasite, which takes from the circulatory vessels of the plant on which it is developed the materials necessary for its growth.

Reference has previously been made to the fact that the solutions of various substances may pass from the maternal to the fœtal blood. The following are the conclusions of Preyer[1] in regard to the reciprocal relation of the maternal and fœtal blood:

1. Very many substances in solution, easily diffusible, can pass from the blood in the sinuses of the maternal portion of the placenta into the capillaries of the villi of the fœtal portion of the same placenta.
2. That oxygen certainly passes from the hæmoglobin of the blood globules of the mother in the placenta, to the hæmoglobin of the blood globules of the fœtus in the capillaries of the villi, as long as there is a sufficient quantity.
3. That some substances in solution, as the sodi-indigosulphite and the potassic iodide, can be directly eliminated from the mother into the amnial liquor without entering the blood of the fœtus.
4. That soluble substances easily diffusible can pass abundantly from the blood of the capillaries of the villi into the blood of the sinuses of the maternal portion of the placenta.
5. That oxygen certainly passes from the hæmoglobin of the blood globules of the fœtus in the placenta to the hæmoglobin of the blood globules of the mother, if the maternal blood contains but a minimum or no trace of the oxygen.
6. That some substances which are soluble may pass from the amnial liquor, probably in small quantity, into the blood of the mother.
7. That formed elements cannot, unless extremely small, probably pass in absolutely intact placentas, and that even then the transmission does not take place uniformly, but only in certain conditions, sometimes dependent upon the organization, as in sheep, sometimes in anomalous states, possibly increase of blood pressure, or by means of diapedesis of leucocytes.
8. That it has not been conclusively proved that formed elements migrate from the blood of the fœtus into the maternal blood in the placenta, but such passage is possible.

From what has been proved as to the action of atropine, the natural conclusion is that soluble salts of opium will readily pass from the maternal to the fœtal blood. Two milligrammes of atropine were given hypodermatically to a woman three hours before delivery; the child was born with dilated pupils which did not react to light. So, too, the belief is probable that a woman who is an opium-eater is liable to give birth to a child affected by morphine; it is possible, too, more remote injury may result.

In one case in which morphine was administered to a pregnant woman by hypodermatic injection, the fœtal pulse became less frequent and arrhythmic.

It has been shown by Porak that when fifteen grains, one gramme, of quinine were given to a woman in labor, the urine in the child, born an hour and a half afterward, showed the presence of quinine. Runge gave to women during several of the last days of pregnancy half a gramme daily of muriate of quinine, and in almost all cases quinine was found in the fœtal urine. Now if, as is alleged by some observers, the child

[1] Op. cit.

may suffer from intermittent fever while in the uterus, obviously there is every reason to believe that the disease may be cured by giving quinine to the mother.

Occasional cases in which intra-uterine vaccination has succeeded, and the transmission of certain diseases believed to depend upon germs, such as syphilis, variola, rubeola, scarlatina, etc., from the mother to the fœtus, testify to the passage of micrococci from the maternal to the fœtal blood.

Circulation. The circulation in intra-uterine life passes through two important phases, while a third is entered upon at the close of that life. The first is very brief, and depends upon the formation of the umbilical vesicle; it is called the vitelline circulation. The heart, still a straight, tubular cavity, gives off from each end two vessels; the two superior are the first aortic arches, and the inferior are the omphalo-mesenteric veins. By the heart's systole the blood entering the aortic arches passes first into the body of the embryo, then into the omphalo-mesenteric or vitelline arteries, which carry it to the vascular area of the vesicle; from there it enters the venous sinus, situated at the periphery of that area. The omphalo-mesenteric veins are formed by branches originating at the sinus, and empty the blood thus collected into the heart during its diastole.

Second, or Placental Circulation. The vitelline is superseded at the beginning of the third month by the placental circulation. The heart is developed into an organ of four cavities, and externally presents the form of the adult heart; internally there are important differences. The most important of these differences is that the septum between the auricles is imperfect; it has a large opening, described by Galen, but to which the name of Botal has been given; it is also called the foramen ovale. Furthermore, the Eustachian valve situated at the entrance of the inferior vena cava is remarkably developed, so that it turns the current of blood coming through the latter vessel into the auricle to the foramen ovale, and thus into the left auricle. Two important structures must also be mentioned before describing the circulation, the venous duct and the arterial duct, ductus venosus and ductus arteriosus; the former connects the umbilical vein with the inferior vena cava; the latter, the ductus arteriosus, which appears as if a continuation of the pulmonary artery, connects the artery with the aorta at a point of the arch just below the origin of the arteries of the head and upper limbs.

The blood, purified and rendered fit for nutrition in the placenta, is brought to the fœtus by the umbilical vein, which enters at the umbilicus; the greater part of the blood passes at once by the ductus venosus into the ascending vena cava, where it mixes with the blood brought from the lower limbs, the pelvis and the kidneys; a small part passes to the liver, and on the other hand blood from the hepatic veins empties into the cava. These various collections, chiefly of course that coming from the placenta, make the common stream which is carried by the vena cava into the right auricle, but the stream is turned by the Eustachian valve through the right into the left auricle, from which it passes, as in post-uterine life, into the left ventricle. The heart now contracting, the contained blood is sent from the left ventricle into the

aorta, from the right into the pulmonary artery. The blood which enters the aorta from the left ventricle passes chiefly to the head and upper limbs; that which goes into the pulmonary artery being needed in only small amount by the inactive lungs, and these organs incapable of exercising their function, the blood does not need them, therefore is in greater part carried by the ductus arteriosus into the aorta; as

FIG. 95.

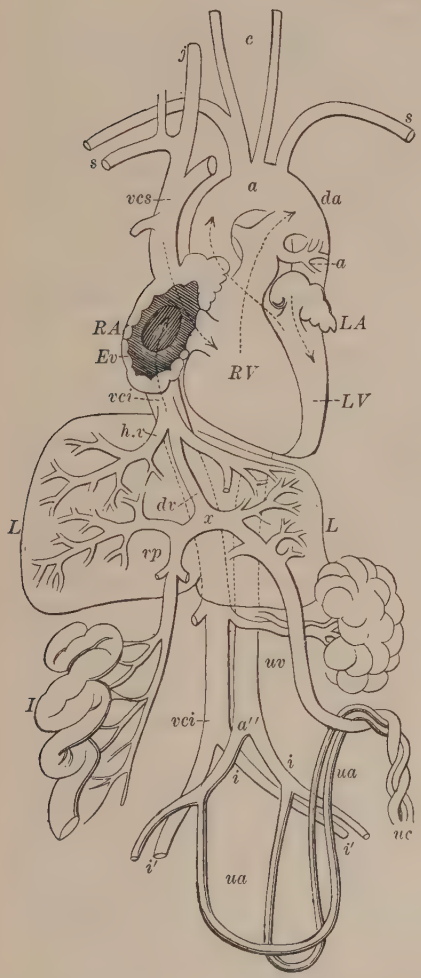


DIAGRAM OF THE CIRCULATORY ORGANS OF THE HUMAN FŒTUS AT SIX MONTHS.

RA. Right auricle. *RV.* Right ventricle. *LA.* Left auricle. *Ev.* Eustachian valve. *L.* Liver. *K.* Left kidney. *I.* Part of small intestine. *a.* Aortic arch. *a'.* Its dorsal part. *a''.* Posterior end of abdominal aorta. *vcs.* Superior vena cava. *vci.* Inferior vena cava near its junction with the right auricle. *vci.* Posterior part of vena cava. *s.* Subclavian vessels. *j.* Right jugular vein. *c.* common carotid arteries; the four dotted arrow-lines indicate the course of the circulation. *da.* Ductus arteriosus; an arrow-line starting at *vci* indicates the course of blood-flow from the inferior cava through the foramen ovale. *hv.* Hepatic veins. *vp.* Vena portæ. *x* to *vci.* The ductus venosus. *uv.* Umbilical vein. *ua.* Umbilical arteries. *uc.* Umbilical cord. *i i'.* Iliac vessels. (ALLEN THOMPSON.)

the ductus venosus transmitted a purified blood, so the ductus arteriosus conveys an impure blood. The aorta, after the ductus arteriosus has emptied its supply into it, contains blood from both the left and the right heart, and transmits this mixed blood to the organs situated below, to the lower limbs, and by the umbilical arteries to the placenta. The blood which was expelled from the right ventricle had been received from the descending vena cava through the right auricle, and it

was therefore an impurer blood than that which was expelled simultaneously from the left ventricle; thus it is plain that the lower half of the body has a blood less rich in nutritive materials than the upper half, and hence the greater development of the latter than of the former, a development which is necessary for the exercise of certain functions in the period of life immediately following delivery. The organ which receives the purest blood is the liver.

At birth that which is often called the third circulation is established. With the first inspiration of the newborn the blood flows in increased quantity to the lungs, and the stream which passed from the pulmonary artery to the aorta through the ductus arteriosus now goes into the branches of the pulmonary artery, and the arterial duct is narrowed, and obliterated in two or three days. The blood coming from the lungs fills the left auricle, prevents that which enters the right auricle passing through the foramen ovale; this opening in the wall between the auricles, not being used, is closed, the closure becoming complete some weeks after birth.

Respiration. The placenta is the respiratory organ of the fœtus. As remarked by Spiegelberg, the mother's blood is for the fœtus the external world from which alike its respiration and nutrition needs are satisfied. The importance of a supply of oxygen for the fœtus is rendered probable by the abundance of hæmoglobin in its blood. According to the investigations of several, the blood of the mature fœtus is richer in hæmoglobin than is that of the mother. Hoesslin found, too, in fœtal blood which contained 13.72 per cent. of hæmoglobin, there were 5.88 millions of blood corpuscles in a cubic millimetre of the blood, a very much larger number than woman's blood has. Preyer, from his own investigations, has concluded that the hæmoglobin in the pregnant woman's blood is never greater, often very much less, than in that of the fœtus.

He also states that important changes of matter occur in the fœtus, as shown by the formation of certain products which are not obtained from the mother's blood, secretions from its glands, or building up permanent structures; exercise of voluntary and of involuntary muscles; the fœtus, too, has a higher temperature than that of the mother's uterus; and all these things indicate the fact that oxygen is necessary for the fœtus. The only source of supply is the maternal blood. The proofs of fœtal blood-changes in the placenta, analogous to those which occur in pulmonary respiration, are the difference of color in the blood coming from and going to the placenta; the fact that, if the placental circulation be temporarily interrupted, the blood in the umbilical vein becomes dark like that in the arteries, and, if the interruption be permanent, the fœtus dies asphyxiated, and the only substitute for placental is pulmonary respiration; finally, spectroscopic examination has proved the presence of oxygen in the fœtal blood.

It has been held that the fœtus requires but a small quantity of oxygen because the nutritive changes are so simple and its activity so slight. But it should be remembered[1] as to the latter point that the heart begins its action early, and that its pulsations are twice as frequent as in the adult; that fœtal movements

[1] Preyer, op. cit.

occur some time before the mother is conscious of them, and that very many take place after she has this consciousness without her recognition, for only those affecting that part of the uterus which is in relation with the anterior abdominal wall can be known by her. In answer to the statement that the nutritive changes are slight, Weiner,[1] from his study of these changes in the fœtus, has concluded that there exists in the fœtus, especially in the last period of fœtal life, a certain number of organs which function as in the newborn. The kidneys act, and this quite early, in relation to certain known substances artificially introduced into the fœtus, exactly as the kidneys of the newborn, and very rapidly excrete these products. Absorption by the lymphatics and rapidity of the lymph currents are very energetic; the intestinal mucous membrane not only absorbs substances in solution, but also fat. These facts connected with that of the active secretion of the liver, of the skin, and of the glands of the intestinal mucous membrane, as well as the relatively pronounced development of digestion of the stomach, and the fermentation properties already present in the extracts of the parotid and of the pancreas, permit us to admit with great probability that the secretory and absorbent organs of the fœtus are capable of performing their functions, and very probably do perform them, as soon as their anatomical structure and degree of development permit.

Secretion. The formation of the sebaceous glands begins toward the end of the fourth month, and in the fifth month their secretion is manifested, and in the sixth month becomes quite abundant. The *vernix caseosa*, *smegma embryonum*, which so generally covers the surface of the embryo, is a whitish or yellowish, inodorous, adhesive matter composed of epidermic cells, sebaceous cells, and fat globules. The epidermic scales make the greater part of the mass, the amount of fatty matter being relatively very small. Depaul, who did not disdain a belief in nature's intelligence, regarded the vernix caseosa as a wise provision to prevent osmosis from the fœtal vessels.

The sudoriparous are developed somewhat later than the sebaceous glands, and probably do not secrete during intra-uterine life, though one of the many theories of the origin of the liquor amnii was that it was formed by their secretion.

That the serous membranes of the fœtus have their normal secretion is shown by those cases in which children are born having this secretion in excess, as in cases of hydrocephalus, of hydrothorax, and of ascites.

The remarkable vascularization of the liver in the fœtus is, according to Kölliker, proof of its great physiological importance; but he regards its *rôle* as an organ of secreting bile as subordinate to that of producing in the blood special chemical and morphological modifications. The secretion of bile begins in the third month; a bile-like material is found in the fifth month in the small intestine, later in the large intestine, the precursor of meconium. The first excrement of the newborn has been called since Aristole *μηχώνιον*, meconium, from its resemblance to the juice of the poppy. Its presence indicates not only secretion from the liver, but also the activity of the intestinal glands, and its descent into the lower portion of the large intestine peristaltic action of the intestinal canal. From the seventh to the ninth month of fœtal life it presents almost the same characters as after birth; it is homogeneous, viscid, feebly acid, without odor, having a greenish, sometimes almost black color; it is composed of bile and intestinal secretions with, in exceptional cases according to some, in all cases according to others,

[1] Archiv für Gynäkologie, 1884.

materials derived from the amnial liquor, such as sebaceous secretion, epidermic scales, and fine hairs.

Preyer states that Huber has described two kinds of meconium which are frequently found in the fœtal intestine, namely, the amniotic meconium, which has as its component the swallowed amniotic liquor, and which is yellow-brown, and the hepatic meconium, which contains bile and is dark green. The latter is also characterized by the presence of yellow-green chiefly ovoidal bodies from 0.005 to 0.03 millimetre in diameter, which Huber has called meconium corpuscles. The forensic proof of meconium may be given by these corpuscles; they are generally surrounded by mucus, insoluble in ether and in acetic acid, but soluble in potash solution.

Discharge of the meconium prior to birth rarely occurs except as a pathological manifestation; it is often observed in children born asphyxiated. The kidneys are exercised during the last half of pregnancy; upon an autopsy made of a fœtus dying during pregnancy, it is usual to find urine in the bladder, and it is not uncommon to see urine escape from the newborn just after delivery, while in some cases it is expelled during labor; hydronephrosis may occur in pregnancy from obstruction of the ureters. Although still in dispute, the probability seems to be that the fœtus from time to time discharges urine into the amnial liquor, for, in addition to the presence of urea in this liquid, in cases of imperforate urethra the bladder is found enormously distended.

Fœtal Movements. Innervation. Passive Ideation.[1] Fœtal movements are usually perceived by the mother some time in the fifth month. According to Preyer, the fœtus moves its upper and lower limbs long before the beginning of the sixteenth week, probably before the twelfth week. Many of the movements of the fœtus are passive, caused by change in the mother's position, by varying abdominal pressure, by uterine contractions, and by external pressure upon the uterus. Others result from changed conditions of the maternal blood, and they are termed irritative movements; many are reflex, and others impulsive. The life of the fœtus is compared to that of a dreamless sleep after birth. But, as Bailly has said, it is probable that a vague and obscure will intervenes in the production of movements which the fœtus exercises after a change of position of the mother, and which appears to have as their object the recovery of a comfortable position of which the movement of the mother has deprived the fœtus. Nevertheless, this view is not supported by Preyer.

The question as to the capability of the fœtus receiving impressions upon the senses cannot be completely answered. As far as sight, hearing, and smell are concerned, no such impressions are possible. Preyer regards it as probable that the development of the sense of taste is the earliest. Kussmaul has shown in one child born at eight, in another at seven months, that impressions upon the gustatory nerves were very distinct, as proved by the different expressions of face and movements of its muscles, as well as those of the mouth, according as sugar or quinine was placed upon the tongue. Jacquemier, Tyler Smith, and

[1] Dr. Mortimer Granville very ingeniously maintains "that *passive ideation*, or the reception of mental impressions, which are fixed as images in the mind, proceeds *in utero*." The argument is interesting even if the conclusion be rejected. Lancet, 1876, vol. ii. p. 851.

Tarnier have each tried the following experiment: The uterus of a pregnant rabbit being exposed, the foot of one of the young was seized with forceps through the thin, transparent uterine wall, and immediately the animal withdrew the member. But this movement on the part of the fœtal rabbit has been by many regarded as simply reflex, and not indicative of pain, though probably such interpretation is erroneous. The imperfect development of nerve ends is regarded as preventing the sensation of pain from external impressions upon the fœtus. Nevertheless, as stated by Tarnier, during intra-uterine life, especially at the end of pregnancy, innervation ought probably to be almost as complete as in the newborn. It is probable, too, as suggested by Harvey, there are periods of alternate rest and action in the life of the fœtus. Doubtless the intra-uterine exercise of the voluntary muscles contributes to their development, if not to the general development of the fœtus.

Infantile Atavism, by Dr. Louis Robinson, *British Medical Journal*, December, 1891: "The theory of Darwin that we are descended from a tree-climbing quadrumanous ancestor led me to test the power of grip in infants, for this seemed to be a habit indicating a means of self-preservation in remote ages, which would most likely be still evident, owing to its supreme importance in the past. The result was that I found that every infant, even those prematurely born, had a very notable grasping power, and that the strongest were able to hang by their hands and support their whole weight for over two minutes and a half."

Dr. Robinson's investigations are referred to in *Revue des Revues*, 1892, and it is stated that if a finger is put upon the foot of a suspended child, it tries to grasp it with the foot. "This instinctive movement is evidently a character derived from the habitude of primitive races, which constitutes moreover a predominant quality of all quadrumana."

PLURAL PREGNANCY. When the uterus contains two or more fœtuses the pregnancy is plural. If there are two fœtuses, they are twins; if three, triplets;[1] if four, quadruplets; and if five, quintuplets; and the pregnancies receive corresponding names, double, triple, quadruple, and quintuple. There is no[2] established case in which a woman gave birth to more than five children at one time. In order that plural pregnancy can occur, a single ovary must furnish the necessary ovules, or some may come from each ovary; or, in case of twins, one ovisac may contain two ovules, or one ovule two germs, or the germ may split into two germs.

Frequency. According to the investigation of G. Veit of 13,000,000 births in Prussia, twins occur once in 88, triplets once in 7910, and quadruplets once in 371,126. In recent years there are about twelve authentic cases of quintuplets, from various countries (Kaltenbach). The frequency varies in different countries. Pliny stated that it was greatest in warm climates, but modern statistics do not sustain this theoretical opinion. Thus in France and in Belgium there are scarcely

[1] Readers of Livy's History of Rome will recall the combat, in the war of the Romans and the Albans, between the brace of triplets, three representing each army, the Horatii and the Curiatii.

[2] Nevertheless this statement as to five being the largest number of fœtuses in the human female must be set aside, for last year the case of an Italian woman, who in the fifth month of pregnancy miscarried, expelling six fœtuses, was reported, and the truthfulness of the report is generally conceded. See London Lancet, October 20, 1888.

Soon after the publication of this case of sextuplets in Italy, some patriotic American Ananias published in a Western newspaper an account of a similar event having occurred in the interior of Texas, with a description of the six living children, stating also the names that had been given them.

ten twin births in a thousand cases of labor, while in Denmark and in Sweden the proportion is between fourteen and fifteen, in Ireland between sixteen and seventeen to the thousand.[1] It is thus evident that climate is not a factor in determining the frequency of plural pregnancies. A remarkable difference in the proportion[2] of twin to single pregnancies is found in different Italian cities. While in Genoa there is 1 to 54, Milan 1 to 56, in Palermo the proportion is only 1 to 114. Between Genoa and Milan at one extreme and Palermo at the other, in regard to the relative frequency of twin pregnancies, are placed Padua, Trente, Turin, Bologna, and Naples.

Causes. In addition to climate, race, stature, and the great development of the ovaries have been regarded as causes of pluriparous pregnancies. But, whatever influence may be attributed to any of these, the chief causes are multiparity and heredity. The statistics of Duncan show that the number of pluriparous multiparæ is about eight per cent. greater than that of pluriparous primiparæ; those of Puech show that multiparæ have triplets eight times as often as do primiparæ. Heredity seems to be a more potent cause. Female twins often give birth to twins. A woman had twin pregnancies three times, her daughter had two twin pregnancies, and her daughter in turn a twin pregnancy. Instances in which this manifestation of heredity was transmitted to the male are also recorded. Leroy states that four brothers, in whose family twin pregnancies in the parents of a collateral branch had been observed, procreated twins—three of them twice each, and the fourth four times.

The cases just cited indicate that excessive fecundity, though usually belonging to the female, as a cause of plural pregnancy, may depend upon the male.

Sue mentions the case of a man whose wife gave birth to triplets seven times in seven years, and then seducing his servant girl she gave birth to triplets. Nor is the case of the Russian peasant, Feodor Wassilief, to be omitted. It was quoted by Velpeau from Merriman;[3] this peasant was married twice, and his first wife had quadruplets four times, triplets three times, twins sixteen times, in all sixty-nine children; his second wife had triplets twice, and twins six times, making her contribution only eighteen to the entire number of seventy-seven. Moreover, eighty-four of these children and the father, who was then eighty-five years old, were living at the time the English merchant, whose story Merriman publishes, visited Russia.

In sixty-one cases of twin pregnancy, analyzed by Kleinwächter, the youngest mother was nineteen, the oldest forty-one years; in $67\frac{22}{100}$ the pregnancies occurred in women between twenty-three and twenty-nine years of age, a fact which does not sustain Matthews Duncan's view that "pluriparity is an unnatural or abnormal condition connected with sterility by being observed in the sterile ages, or ages of weakness or imperfection of the reproductive power.[4]

[1] Berlin, Nice-Médical, December, 1888, in the study of the births at Nice for twenty-seven years, in all 56,505, finds that the proportion of twin births was 1 in 75, of triplets 1 in 5575.

[2] De l'Obstetrique en Italie. Millet.

[3] Merriman apparently believed the story, for in quoting it from the Gentleman's Magazine, 1783, he also quotes the following: "The above relation, however astonishing, may be depended upon, as it came directly from an English merchant in St. Petersburgh to his relation in England, who added that the peasant was to be introduced to the Empress."

[4] Sterility in Women.

SUPER-IMPREGNATION. The question naturally suggests itself as to whether the ovules which are developed in plural pregnancy are fecundated simultaneously or at different times. In the case of many of the pluriparous inferior animals fecundation is simultaneous; for example, the boar impregnates the sow at a single coition. So it may be in the human female, and possibly is in the majority of cases. But super-impregnation is, arbitrarily at least, divided into super-fecundation and super-fœtation. By the former is meant the fecundation of one or more ovules after one has been fecundated, that is, successive instead of simultaneous fecundation; by super-fœtation[1] is meant fecundation effected after the uterus is occupied by the product of conception. The latter requires the occurrence of ovulation several days, weeks, or even months after the ovule was liberated which was first impregnated.

That super-fecundation may occur in the human female, as well as in some of the inferior animals, is certain. Thus a white woman has twins, one a mulatto, the other white; or of a black woman's twins one is black, the other a mulatto. The only rational explanation is that in each case each child shows a different paternity. A mare may be covered by a stallion, and at an interval varying from a few hours to fifteen days is covered by an ass; she has twins, one a horse, and the other a mule. A bitch in heat is covered by different dogs, and in her litter the puppies may indicate different fathers.

But when super-fecundation occurs in the human female, the fact is presupposed that the ovules impregnated are liberated from their ovisacs at the same menstrual period. Nature intended her to be uniparous, and once fecundation has occurred ovulation[2] usually is suspended, so that the probability of super-fœtation is at once opposed by a physiological reason; in other words, there is no ovule to be impregnated. This is admitted as a law; nevertheless, as claimed by some, there may be exceptions.

There is, however, an anatomical argument derived from the condition of the uterine cavity occupied by the developing ovum; room for the spermatozoids to pass to the ovule, and then space for the entrance of the latter into the uterus, present theoretical objections. It must, however, be admitted that prior to the union of the ovular and uterine decidua, which, as has been before stated, occurs some time in the fourth month, there is no invincible anatomical obstacle to a new impregnation occurring. Nevertheless, with the difficulty just mentioned, and with the physiological one arising from the suspension of ovulation during pregnancy, the improbability of the occurrence of super-fœtation is very great; the strongest argument against super-fœtation is given by Auvard in the fact that in five-sevenths of plural pregnancies there is but a single placenta. Auvard also states that super-fœtation is only possible in cases of a double uterus or of an ectopic gestation.

[1] In regard to super-fœtation in animals, some curious and absurd statements are made by Herodotus; see Cary's translation, p. 216.

[2] Playfair gives the occurrence of menstruation as a proof of ovulation. Before admitting such an argument, it must first be proved that menstruation does then occur; next it must be proved that ovulation and menstruation are always necessarily connected. A woman may menstruate after her ovaries have been removed; and, according to Playfair's argument, she necessarily ovulates.

The hypothesis of super-fœtation is proposed, first, to explain those cases in which there is simultaneous expulsion of the products of conception, one large, well-developed fœtus, and the other a small and feeble fœtus,[1] or the second product may be still in the embryonic condition. But twins usually differ in size and vital power, and this difference may be so great that the feeble ones dies soon after birth: it may depend upon the fact that one was better supplied with nourishment than the other and prospered to the detriment of its companion, or there may have been an inherent difference in the vitality of the ovules impregnated. Where one product was still embryonic and the other well developed, the answer is, the former died early in pregnancy and remained without material change until the pregnancy ended.

But, second, the hypothesis is thought to explain the cases in which several days, weeks, or, as is alleged in some cases, months intervened between the birth of twins. In some of these instances the mother was found to have a double uterus; one fœtus was contained in one-half, the other in the other half of the organ; and under such circumstances possibly a considerable interval occurred between the impregnations. But most of the cases correspond to a premature labor or miscarriage with one fœtus, while the other was retained until full term or somewhat beyond.

Many of the facts adduced to prove super-fœtation belong to a past age, when such marvels were more readily accepted than to-day; and as a rule they fail in the details and thoroughness of investigation necessary to establish their truth. "Few authors to-day believe in the reality of super-fœtation."[1] Doléris suggests that super-fecundation—that is, the fecundation of several mature ovules expelled from the ovisacs at the same period—may occur within fifteen days, or at most three weeks; after about this time fecundation seems impossible.

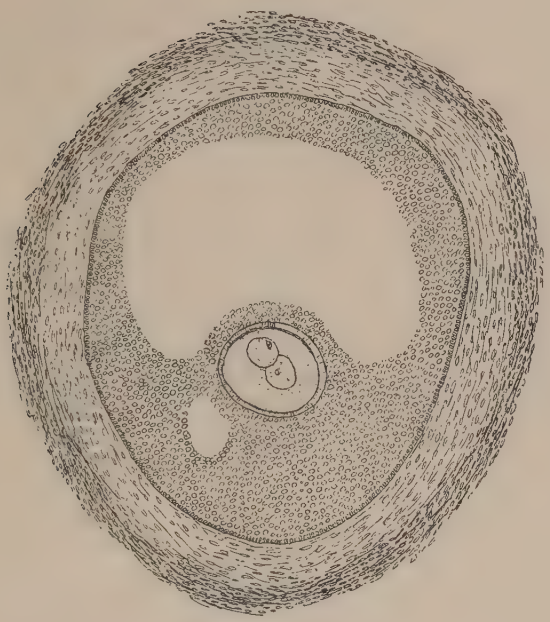
Fœtal Appendages in Twin Pregnancies. Where two ovules from different ovisacs are impregnated, each fœtus has its own chorion and amnion, and originally the ovular decidua of each was distinct, but the portion intervening between the two sacs is absorbed, so that they have a common decidua. The placentæ may be closely united, but there is no vascular connection; there is entire independence as to the circulation in each.

If there be a single placenta with one chorion and two amnions, either there were two germs in one ovisac, or the germinal vesicle has furnished two germinal areas. The bloodvessels of the twins communicate in the placenta. (Fig. 96.) Either the twins are well developed, or the greater heart activity of one takes away the nourishment needed by the other, and the latter dies. The twins are of the same sex. Most rarely there are one placenta, one chorion, and one amnion. The amnion folds between the two may have been absorbed because of pressure; or the origin of the twins may have been from the division of a germ; the twins are of the same sex.

[1] In a litter of pigs it is not unusual to find one, generally the last born, smaller, feebler, and more poorly developed than any one of its brothers or sisters; it is commonly known as the runt; but farmers never adduce this fact as a proof of super-fœtation.

[2] Doléris.

FIG. 96.



GRAAFIAN FOLLICLE WITH TWIN OVULES. (After v. HERFF.)

SEX, SIZE OF TWINS, COURSE OF THE PREGNANCY. In the great majority of cases twins are of the same sex, and males predominate over females. The united weights of twins at birth is usually greater than that of a single fœtus at the same period of development, but the weight of each is considerably below the mean; generally one of the twins is larger and stronger than the other. One of the children may die early in the pregnancy, and either be expelled with its appendages and pregnancy go on, or be retained and the liquor amnii absorbed, while it undergoes the change called mummification; or it may be pressed against the uterine wall by the other fœtus and its membranes, so that it is flattened, making a thin mass called fœtus *papyraceus*. In other cases the condition previously mentioned as to the heart of one of the twins having greater power than that of the other may be present, and the latter fail in development, except as to the lower part of the body and lower limbs, and a monster known as *acardia* results, while the former is perfectly developed.

Abortions, polyhydramnios, and monstrosities are more frequent in plural than in single pregnancies; acephalous monsters are only found in the former.

Premature labor frequently occurs in twin pregnancies, its usual cause being excessive distention of the uterus. Triple pregnancies rarely, and quadruple probably never, reach the normal term.

CHAPTER VI.

CHANGES IN THE MATERNAL ORGANISM.

The changes in the impregnated ovule having been traced from their beginning in conception to their end in the completely developed fœtus, there are now to be considered the modifications which pregnancy causes in the maternal organism ; in a word, to present the natural history of pregnancy in regard to the mother. The changes in the maternal organism caused by pregnancy may be divided into general and local.

General Changes. These chiefly involve the digestive apparatus and nutrition, the heart and the blood, respiration, the nervous system, the skin, and the urinary apparatus and secretion.

Morning Sickness. Gastric disturbance is an almost constant phenomenon manifested in the first month of pregnancy. From the fact that nausea and vomiting are more frequent in the early part of the day, or if occurring at other times are usually more severe then, the disorder is commonly known as morning sickness. In some cases it may be so slight as scarcely to constitute an indisposition, only a transient discomfort, but in others so severe as to be a grave disease. It may begin soon after the supposed time of conception, but more frequently at the first following menstrual suppression ; in either case it usually abates or disappears some time in the fourth month. In most cases the desire for food is lessened, and in women whose nausea is great or constant disgust may supersede desire.

In a very few cases pregnancy seems from the first to increase the appetite, digestion is good, and the subject is in better health than usual. In still others the appetite may be capricious, fickle as to kinds of food, or wishing for those articles which at other times are not cared for, or, finally, it may be perverted. The whimsical or perverted appetences of pregnant women, commonly known as "longings," are in some cases assumed, or imaginary, not real ; a primigravida, for example, has read or heard stories of such "longings," and believing them natural to her condition, the step is but a short one to imagining she has them. In the word mother-marks there is perpetuated the once popular belief that if the desire or longing of the pregnant woman for some particular article of food is not gratified, the fœtus will be marked.

Pliny used the word *malacia* to express the "longings" of pregnant women. A distinction has been made by some between *malacia* and *pica*, the former being used to signify that the appetite sought unaccustomed, but still nutritious, substances for food, while in the other there was a complete perversion of the appetite, which sought materials, such as chalk or charcoal, that were entirely indigestible, or which were repulsive and disgusting, like feces. But this distinction has not been generally held.

The word *pica* is the Latin for magpie, and was used, Gardien says (*Traité Complet d'Accouchements*), to signify the whimsicalities of pregnant women and of

chlorotic girls, because there was thought to be an analogy between their appetites and the parti-colored plumage of the magpie, or its inconstancy as shown in hopping from one to another branch of the tree on which it is perched.

Strange stories have been told of these "longings," as, for example, of a pregnant woman who longed for salted herring, and ate fourteen hundred during her pregnancy; or of another who longed for a bite of the baker's shoulder, and the kind husband, fearing he would lose his wife if the longing were not gratified, got the baker's consent, and she took two bites; and of another who longed so earnestly to eat her husband that she killed him, ate heartily of his body, and then pickled the rest for future consumption.[1]

In the latter part of pregnancy, before descent of the uterus has occurred, and while the fundus is pressing upon the stomach, some women have a recurrence of gastric disorder, but this is slight and transient. Neither this manifestation nor that of the earlier months should be confounded with the graver form of the disorder, which may occur as a symptom of albuminuria and a forerunner of eclampsia.

It is easy to understand, as observed by Stoltz, that the irregularity or depravation of the digestive functions in the early months of pregnancy must cause imperfect nutrition. "Hence the pregnant woman emaciates in the first month; her appearance is bad—that is to say, her features are drawn, her eyes surrounded by dark circles, and her expression becomes more or less dull. She is sluggish, melancholy, drowsy. In a word, there is developed a condition more or less resembling chloro-anæmia." But the nausea generally ceasing with the beginning of the fourth month, at least before or by the middle of this month, fœtal movements being recognized by the mother, all uncertainty as to her condition is removed, the appetite is restored, digestion becomes better, her general condition is greatly improved, nutritive processes are quickened, and she gains in weight. This increase of weight is greatest in the last three months of pregnancy, being, according to the investigations of Hecker and Gassner, from one kilogramme and a half to two kilogrammes and a half each month. A woman's weight is about one-thirteenth greater at the end than it was at the beginning of pregnancy. "In the cases when the weight lessened in the eighth or ninth month Gassner ascertained conditions unfavorable to nutrition; for example, the death of the fœtus and its retention in the uterus. This phenomenon, observed in three instances, always had as its consequence a diminution of the weight of two to three kilogrammes in a period of eight to fifteen days."[2]

Changes in the Blood and Circulatory Apparatus. The blood-changes resulting from the pregnant state relate to quantity and quality. There is a decided increase in the amount of blood, this increase

[1] In the following passage, from Bartholomew Fair, these "longings" are well satirized: "Oh, yes! Win; you may long to see, as well as taste, Win: how did the 'pothecary's wife, Win, that longed to see the Anatomy, Win?—or the lady, Win, that desired to spit i' the great lawyer's mouth, after an eloquent pleading?"

The universal and deep-rooted popular belief in the "longings" of the pregnant woman, and the necessity for their gratification, have no more striking illustration than is given in one of the Coventry Miracle Plays (Ancient Mysteries Described; Especially the English Miracle Plays, by William Hone, London, 1823). Mary and Joseph are passing along the road, when they come to a cherry-tree laden with ripe fruit; she "longs" for the cherries, which he refuses to get for her, when the tree miraculously bends its branches to her, and her wish is at once gratified. Hone states that a Christmas carol founded upon the play, and in which this incident is fully given, was in his day sung in London and many parts of England. There was not a thought of irreverence in play or in song. The event was regarded as natural and necessary.

[2] Tarnier.

beginning about the middle of pregnancy. When we consider the greater nutritive demands, especially for the fœtus and its appendages and for the uterus, and the larger area of the circulation, an increase in the quantity of the blood is obviously necessary. It has until quite recent years been held that in the course of pregnancy the watery portion of the blood became more abundant, the fibrin and the white corpuscles increased, and the red corpuscles lessened. But the researches of Fehling,[1] Reinl, and Richard Schröder prove that the hæmoglobin and the red corpuscles are notably increased. Vinay,[2] while admitting that in the majority of cases the blood becomes richer, the globules more numerous, their globular value augments, and these modifications confirm the theory of plethora, so long admitted by physicians, that this globular richness undergoes exceptions, and in some women pregnancy is the occasion of anæmia.

Hypertrophy of the heart, as a constant phenomenon of pregnancy, was first made known by Larcher in 1857. This hypertrophy, like that of the uterus, disappears after the pregnancy has ended. By Blot the increase in the weight of the heart was stated to be about one-fifth. Löhlein[3] and Gerhardt have denied cardiac hypertrophy in pregnancy. The recent investigations of Dreysel, in the Munich Pathological Institute, prove that there is a slight eccentric hypertrophy of the heart, chiefly of the left side.

The greater activity of the circulation is manifested by increased arterial tension. The veins, too, are fuller, and varicose enlargements frequent.

Respiration. The base of the thorax is increased during pregnancy, while its vertical and antero-posterior measurements are lessened; but it seems doubtful if the former increase in the pulmonary capacity compensates for the loss resulting from the two other changes mentioned. The pregnant woman, when the uterus has risen so high as to interfere with the normal descent of the diaphragm in inspiration, suffers from hurried breathing, or from dyspnœa, when making great bodily exertion, as in rapid walking or ascending steps.[4]

The quantity of carbonic acid eliminated by the lungs constantly increases as pregnancy advances.

Urine and Urinary Apparatus. The blood now being increased, as well as the arterial tension, the quantity of urine secreted is greater. But this increase of urine is almost exclusively of its watery portion; with the exception of the chlorides, the solid constituents progressively lessen with the duration of the pregnancy. The lessened elements are phosphates, sulphates, urates, uric acid, creatin and creatinin; and the suggestion, which in part seems quite probable, has been made that the lessened elimination of these in the urine may result from their being used in fœtal development.

[1] Runge, Geburtshülfe, second edition, 1894, and Kaltenbach, Lehrbuch der Geburtshülfe, 1893.
[2] Traité des Maladies de la Grossesse, 1894.
[3] Lehrbuch der Geburtshülfe, second edition, 1893.
[4] This fact would seem conclusive as to lessened pulmonary capacity. Nevertheless the measurements made by Kuchenmeister, Fabius, Wintrich, and more recently by Vegas in Winckel's clinic, show that there is no change even in the latter months of pregnancy.

Kyestein, from the Greek κύησις, pregnancy, is, as described by Nauche in 1831, a white, grumous, soft pellicle found upon the urine of a pregnant woman about thirty-six hours after it has been passed; about the fifth day this pellicle breaks up and falls to the bottom of the vessel. The late Dr. Elisha Kent Kane, who became so famous as an Arctic explorer, in 1841 verified by observations at the Philadelphia Hospital the statements of Nauche and other foreign investigators as to the presence of kyestein in the urine of pregnant women, and as to its character. Subsequent investigations, however, have proved that kyestein is not an organic substance, but is chiefly composed of ammonio-magnesium phosphates, vibrions and monads; it may be found in the urine of the non-pregnant as well as in the urine of pregnant women, and also in that of the male.

Renal congestion may result from compression, and *albuminuria* follow. According to Spiegelberg, it is not rare to find albumin in the urine, especially during the latter weeks of pregnancy, and he regarded it as usually depending upon a vesical catarrh. The results of observations made in the Philadelphia Hospital lead me to believe that albumin is not found in the last month of pregnancy oftener than in one out of ten women. In a very small proportion, probably not more than 6 per cent., *sugar* is present in the urine in the last weeks of pregnancy.

The close attachment of the bladder to the uterus produces changes of position of the former corresponding with those of the latter organ; thus, in the earlier weeks of pregnancy, the bladder descends somewhat with the uterus, and its full expansion is prevented; hence *vesical irritability* is one of the first symptoms of pregnancy. Observation shows that the majority of pregnant women suffer from some disturbance or disorder of the bladder, the liability being greater in primigravidæ than in multigravidæ.

CHANGES IN THE SKIN. Pigment deposits may occur upon the face, the forehead, the mammæ, the labia, and upon the abdominal walls. Pigmentation of the mammæ and nymphæ will be described in another place. Irregular yellowish-brown patches upon the forehead and the face form what has been called the mask of pregnancy. The intensity of the color[1] varies in different subjects; the patches become less distinct after pregnancy, but do not disappear, and are renewed at each succeeding pregnancy. In most cases a pigment deposit is found in the median line of the abdominal wall; it is more marked in brunettes than in blondes, but is very indistinct in those having red hair. The pigment band is two or three fingers' breadth, and reaches from the mons veneris to the umbilicus, in some cases to the xiphoid cartilage, and then there is a ring of discoloration about the umbilicus, the umbilical areola; the band is more distinct below than above. No satisfactory explanation of these discolorations has been given, though they probably are the consequence of a more rapid destruction of red corpuscles. Dr. Barnes[2] has suggested that the pigmentation of pregnancy is dependent upon a functional modification of the supra-renal capsules, while Jeannin[3]

[1] "Bomare, in article cited by Blumenbach, mentions a French peasant whose abdomen became entirely black during each pregnancy; and Camper gives an account of a female of rank who began to be brown as soon as she was pregnant, and before the end was as black as a negress. After delivery the color gradually disappeared. Le Cat relates the case of a female who was similarly affected in the face only during three successive pregnancies; and Gardien has recorded another." (Laycock on the Nervous Diseases of Women.)

[2] Transactions of the American Gynecological Society, vol. i.

[3] Gazette Hebdom., 1868

attributed it to the amenorrhœa of pregnancy. Localized[1] eczema and seborrhœa, especially upon the face and head, are often seen.

The anterior wall of the abdomen becomes thinner. The enlarged uterus causes it to project, the projection being much more marked when the woman is standing than when she is lying; thus, according to Schröder, the measurement at the end of the pregnancy, from the xiphoid cartilage to the pubic joint, is, if she be standing, eighteen inches and a half, 47 centimetres, but if she be lying, it is a little less than sixteen inches, 40 centimetres.

During the first three months of pregnancy the umbilical depression is slightly increased, or unchanged; in the fifth month it has become less, and at seven months has disappeared; in the last two months there is more or less umbilical protrusion.

Striæ, *striæ gravidarum*, *lineæ albicantes*, or cicatrices of pregnancy, usually occur in the first pregnancy, and it is not uncommon for new ones to be observed in subsequent pregnancies. These striæ are in most cases abdominal, but in some are found upon the hips and thighs, and then are not connected with the pregnant state, or they are upon the breasts; the last in most instances originate after labor. When recent they have a pinkish or bluish-red tint, but after labor they become white, or pearl-colored; generally their surface is depressed, but in some cases, as the result of serous effusion from compression of the epigastric vein, it is prominent. They are caused[2] by partial or complete atrophy of the lymph spaces, partial atrophy of the skin, and longitudinal arrangement of the fibres of connective tissue. They are generally in four concentric zones, the centre being an inch or more below the umbilicus. They do not usually become well-marked until the seventh month, and in the primiparous are a sign of some value in the diagnosis of pregnancy; nevertheless they are absent in from six to ten per cent. of pregnant women. Montgomery[3] mentions the case of a woman who had borne five children, nursing three of them, and yet there were no cicatrices. According to Credé they are absent in 10 per cent., and according to Hecker in 6 per cent. Schultze has found them in 36 per cent. of women who have not borne children.

Changes in the Nervous System. Pregnancy increases the nervous sensibility, and hence numerous reflex disturbances may occur. There may be occasional rigors, dizziness, flashes of heat, hysterical disorders, fainting, disturbances of special senses, especially of sight and hearing, and neuralgic affections, those of the teeth being very frequent.

In regard to the mental state, the general rule is women become more sensitive, and in the majority, probably, despondent feelings prevail. Dr. Hodge has remarked that "gestation has a very happy influence upon the minds of a few women; they feel well, their mental powers are active, their imagination excited, so that they become more interested in reading, writing, or other intellectual pursuits than at any former period; they become more cheerful, and more interested in the ordinary affairs of life." Unfortunately this picture is of the few. A larger

[1] Spiegelberg.
[2] See contribution by Dr. Busey, Transactions American Gynecological Society, vol. iv.
[2] Signs of Pregnancy.

number have needless anxiety as to their safely passing through labor and as to the life and health of their offspring. The majority, however, as the pregnancy goes on, become reconciled to their condition, and patiently wait its end, while some indeed look forward to becoming mothers with joyful expectation. Even in those women whose pregnancy is marked by despondency and anxiety, it is not unusual as it approaches its end to find the cloud lifting, and they are ready to meet their final trial patiently, bravely, and hopefully.

Osteophytes—Hypertrophies of Various Organs. Before describing the modifications of the sexual organs caused by pregnancy, brief reference will be made to some other changes. Osteophyte was the name given by Lobstein to a formation originating from the bone or from the periosteum. Rokitansky, in 1838, found in post-mortem examinations that in more than one-half of pregnant women there were growths upon the internal table of the cranial bones, and external to the dura mater, bone-like formations which he called osseous neoplasms or osteophytes. Similar deposits have been found upon the inner surfaces of the pelvic bones of women dying in childbed. Osteophytes have no effect upon the cerebral functions, nor do they belong exclusively to pregnancy, for they have been found in the tuberculous. In addition to hypertrophy of the heart, which has been referred to, and that of the uterus, which will be hereafter described, some other organs, among which are the spleen, the kidneys, the liver, and thyroid gland, increase in size in the pregnant woman. The increase in the spleen is about one ounce and a quarter, forty grammes. Since Democritus, swelling of the neck has been popularly regarded as one of the signs of conception, and Cazeaux has remarked that hypertrophy of the thyroid gland, independent of any local disease or of endemic influence, is not rare during pregnacy. If the thyroid be hypertrophied in a pregnancy, the hypertrophy lessens subsequently, but does not entirely disappear, and it increases with each succeeding gestation.

Local Changes. Under this head it is proposed to describe modifications which occur in the external and internal genital organs, and in the parts adjacent to them, in the pelvic joints, and in the mammary glands.

Changes in the External Organs of Generation and of the Vagina. It is not until about the fourth month of pregnancy that changes in the external genitals are noticeable. The secretion of the vulval glands is increased; the great and the small lips are larger, more elastic, resisting, and darker, pigmentation often being quite decided upon the external surfaces of the labia majora; the veins and venous plexuses are fuller; in some cases varicosities are present; the vulval orifice is more open. A greater supply of blood in the vagina causes distinct throbbing of the vaginal arteries—the vaginal pulse—which Osiander spoke of as one of the signs of pregnancy. From venous stasis the color of the vagina changes, becoming much darker, so that it is purple or of a violet hue, which is regarded by Jacquemin and Kluge as an almost certain sign of pregnancy; its value, however, is lessened by the fact that a similar change of color has been observed in menstruation. The temperature of the vagina is slightly increased;

its mucous membrane is swelled; a more abundant secretion is present, and the papillæ are larger and more distinct, so that the surface may be somewhat rough. The muscular coat, especially in the upper half of the vagina, is hypertrophied. The vagina is lengthened by the ascent of the uterus, but shortened again when the uterus descends, and also then greatly expanded, admitting the entrance of the presenting part of the fœtus covered by the uterine walls.

Changes in the Perineum. The perineum is more freely supplied with blood, it is somewhat hypertrophied, and it is gradually prepared for the great distention to which it is subjected in labor. Tarnier states that in many experimental applications of the forceps in women who died in pregnancy, or soon after labor, and in others who died not having been pregnant, he found in the last the perineal floor quite resisting and very liable to rupture.

Changes in the Pelvic Joints. These joints are swelled and softened, and some movement in the pubic joint can usually be detected; but the opinion that in either this or in the sacro-iliac joints there is great increase of pelvic diameters, facilitating the passage of the child, is not generally held by obstetricians.

Changes in the Uterus. These are the most important of all the modifications in the maternal organism caused by pregnancy. They affect the structure, size, capacity, form, weight, position, relations, and functions of the uterus. Some of the modifications of the uterus may occur independently of the presence of the ovum in its cavity, for they are present in extra-uterine pregnancy, but they are then limited in degree and in duration. It will be convenient to consider first the changes which occur in the body, and then those in the neck of the uterus.

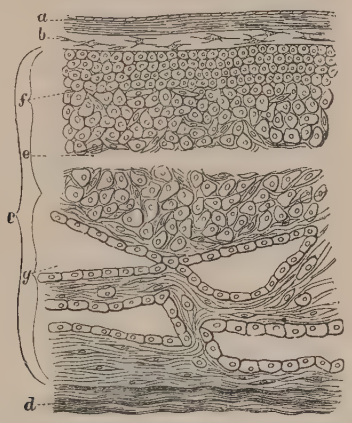
Modifications of the Uterine Walls. A larger supply of blood to the uterus causes increased growth of its tissues. The muscular fibres become relatively colossal, increasing from seven to eleven times in length, and from two to five times in breadth; "embryonic muscle cells, that have been stored up for the time of need," now grow into larger and contractile forms; both hypertrophy and hyperplasia occur. The serous coat is also developed in correspondence with the general growth of the organ, but its connection with the underlying muscular tissue is probably as intimate as in the non-pregnant condition.

The very great hypertrophy of the mucous membrane has been stated, and the early history of the deciduous membranes traced. By the end of the third month of pregnancy the decidua of the ovum, ovular decidua, *decidua reflexa*, and the uterine decidua, *decidua vera*, are in contact. In the course of the fourth month the two layers coalesce, making a single membrane, which in turn is closely united with the chorion, the external covering developed by the ovum, and thus the ovum has not only the closely united chorion and amnion, but also external to these the decidua. The mucous membrane of the uterus in pregnancy has no longer ciliated, but pavement-epithelium.

The decidua, formed by the conjoined ovular and uterine decidua, atrophies, grows thinner, and in preparation for being thrown off with the ovum gradually becomes detached from the uterus. But the mus-

cular tissue is not left bare by this detachment. Some physiologists, among them Robin, asserted that a new mucous membrane begins forming behind the decidua at four months; Dr. Matthews Duncan's criticism upon this view is that it implies at some time the muscular tissue was left bare, and that it produces upon its surface a mucous tissue heterologous to it. According to Friedländer, the decidua is at the end of pregnancy reduced to two layers, superficial and deep; the latter is composed of glandular culs-de-sac and connective tissue, and the former of cells in fatty degeneration, and this only is thrown off. Engelmann also states that only the superficial part of the decidua vera is discharged. Ercolani[1] taught that the uterine decidua was a product of materials elaborated by the utricular glands, and that the ovum, arriving in the uterus already covered by this decidua, soon itself receives a similar investment, this covering fixing it at a particular part of the uterus. The deciduous membranes were regarded by him as exudations, new formations. His views have not met professional acceptance.

FIG. 97.



SECTION THROUGH THE DECIDUA. (FRIEDLÄNDER.)

a. Amnion. *b*. Chorion. *c*. Decidua. *d*. Uterine muscle. *e*. Line of separation in the cellular layer. *f*. Cellular layer. *g*. Glandular layer.

MODIFICATIONS OF ARTERIES AND VEINS OF THE UTERUS. The arteries of the uterus increase in length, in volume, and in number. Jacquemier has stated that their increase in length cannot be attributed to their becoming less flexuous, for they are more flexuous at the end of gestation than they are in the non-pregnant uterus. The ovarian arteries acquire a diameter of nearly one-sixth of an inch, four and a half millimetres, and the uterine arteries are still larger; the branch on each side connecting the uterine and the ovarian arteries is larger than the radial; its course is nearly parallel with the epigastric, and it has received from Glenard,[2] who thought it the seat of the uterine souffle, the name of puerperal artery. Arteries upon entering the uterus sud-

[1] Utricular Glands of the Uterus. Translated from the Italian by Dr. H. D. Marcy.
[2] This theory of the uterine souffle has been proved erroneous.

denly enlarge; branches of the one side anastomose freely with each other and with those from the other side; they are situated nearer to the peritoneal than to the mucous coat, except in the vicinity of the placenta; those which pass to the mucous coat make numerous subdivisions, and end in an extensive capillary network. The venous system in the muscular coat is composed of a large number of sinuses or large canals which communicate with each other; some of the vessels are as large as the little finger. They are without valves, and in the middle muscular layer are reduced to a single coat, which, however, is closely adherent to the surrounding muscular fibres. They are more numerous in the vicinity of the placenta. The ovarian veins become almost equal in size to the external or internal iliac.

Changes in the Size, Capacity, and Form of the Uterus. Increase of the constituents of the uterus is associated with remarkable development of the organ in size and capacity. The uterus undergoes very great eccentric hypertrophy, so that at the end of pregnancy it measures, according to Spiegelberg, about twelve inches and three-quarters, 35 centimetres, in length, about nine inches and a half, 24 centimetres, in breadth, and antero-posteriorly nine inches, or 23 centimetres. The late Sir James Simpson gave the following measurements of the uterus: length twelve to fifteen inches, breadth nine to ten inches, the antero-posterior measurement six to eight inches. He further stated the surface of the unimpregnated uterus is five or six square inches, and its capacity one cubic inch; but at the end of pregnancy the surface of the organ is three hundred and fifty square inches, and its capacity four hundred cubic inches. Tarnier regards the last measurement as somewhat exaggerated; Krause states the capacity is increased 519. The weight of the uterus is twenty to twenty-four times greater than in the virgin state. Spiegelberg attributed the greater size of the uterus partly to the organ being stretched by the ovum, claiming that the thickness of the walls, which increases during the first months, diminishes in the latter months so that it is less than before impregnation. Velpeau and Depaul both held that pregnancy caused no great change in the thickness of the walls, a view sustained by Charpentier; the uterine walls are thinner at the inferior segment, thicker in the fundus and body, especially at that part to which the placenta is attached, according to Naegele and Grenser. Tarnier holds that the thickness generally lessens toward the end of pregnancy, but is quite variable in different subjects, and is very unequal in different parts. It is impossible, therefore, to fix a uniform measure for the thickness of the walls of the pregnant uterus.

The uterus has different forms in the successive periods of pregnancy. During the first three months it becomes pyriform instead of triangular. After three months it gradually takes the form of a flattened spheroid, and it is only in the latter part of pregnancy that it becomes ovoidal, the smaller end of the ovoid being below. Nevertheless, as remarked by Spiegelberg, the uterus is not to be regarded, especially in the latter months, as a rigid body with a constant form, for many deviations occur, the shape depending upon the woman's position, the volume of the ovum, the situation of the fœtus, the tension of the organ, and also upon its primitive formation.

Changes in the Position of the Uterus and in the Consistence of the Uterine Walls. Modifications in the weight and in the size of the uterus necessarily cause changes in its position. It is generally taught that in the first weeks of gestation the uterus is lower in the pelvis; and indeed a flattening of the hypogastrium caused by this descent is regarded as one of the earliest signs of pregnancy. Tarnier thinks this change far from constant; in a great number of women the fundus of the uterus from the first weeks of pregnancy passes the superior pubic margin, and the neck does not descend. However this may be, at three months the fundus is a finger's breadth or more above the pubes; at the end of the fourth month it is two inches or more, five to six centimetres, above; at five months 3.5 to 3.9 inches, nine to ten centimetres, above; the distance of the fundus above the pubes increases, becoming greatest in the first half of the ninth month, when it amounts to 8.6 to 9.4 inches, 22 to 24 centimetres. In the last two weeks there is usually a marked descent, arising from the entrance of the fœtal head, still, however, inclosed in the uterus, into the pelvic cavity. It should be remembered that in the multigravida previous relaxation of the abdominal wall permits the uterus to project further in front, and does not compel the fundus to ascend as high as does the tense abdominal wall of the primigravida. Further, in the latter the descent of the presenting part into the pelvic cavity occurs earlier. While the chief factor in producing this descent is the resistance of the abdominal wall to further encroachment of the growing uterus, yet another factor is the uterus itself, which in the primigravida is more rigid, and, according to Martel,[1] this rigidity maintains the axis of the fœtal ovoid in correspondence with the axis of the uterus, hence there is a tendency to force the lower part of the uterine ovoid into the pelvic cavity.

The uterus after ascending into the abdominal cavity in very few cases occupies a median position, for its posterior convex wall is not adapted to the convexity of the spine, and the organ therefore turns to one or the other side—to the right side in the great majority of women. This obliquity of the uterus, probably having its cause in a condition of embryonic development, should be borne in mind in case gastro-hysterotomy is to be done. So, too, the normal latero-version may in labor retard the descent of the fœtal head, and require to be corrected by changing the position of the woman. But in addition to the usual right obliquity, there is also a partial rotation of the uterus by which the left side of the organ is thrown forward, and the right backward, a change very plainly dependent upon its embryonic development, as has been previously mentioned. This change of position causes the left side of the uterus to be more accessible in auscultation made for the purpose of hearing the uterine souffle.

The consistence of the uterine wall is greatly changed. Instead of being rigid and resisting as in the unimpregnanted uterus, it becomes yielding to localized pressure from within or from without; but it is also elastic, so that as soon as the pressure is removed there is complete res-

[1] De l'Accommodation en Obstétrique.

toration of form. As Pajot observes, this suppleness and special elasticity of the uterus are neither softness nor a flaccid condition; it is always possible to distinguish the uterus from the abdominal walls, and, on the other hand, the suppleness and elasticity contribute to maintain the normal accommodation of the fœtus, and thus avoid unfavorable presentations and positions without interfering with its active movements.

Relations of the Uterus at the End of Pregnancy. The lower fourth of the anterior uterine wall is in relation with the posterior wall of the bladder; the remaining three-fourths is directly applied to the abdominal wall, but sometimes omentum or intestine may intervene. The fundus is in relation with the transverse colon, part of the stomach, with the anterior margin of the liver, the xiphoid cartilage, and the lower floating ribs. The ovaries and oviducts are close to the sides of the uterus at a point corresponding with the junction of the upper and middle third; this change in their position shows the remarkable development of the fundus of the uterus. Further, the right side of the uterus is in relation with the internal and external iliac vessels, with the obturator nerves, the psoas and iliac muscles, the cæcum and the ascending colon; the left side has similar relations to bloodvessels, nerves, and muscles, and with the descending colon, instead of with the cæcum and ascending colon. The posterior wall is in relation with the rectum, the sacrum, the primitive iliacs, the sacro-vertebral angle, the omentum, the small intestine, the aorta, the vena cava, the dorsal and lumbar vertebræ, and the pillars and the posterior part of the diaphragm.

Properties of the Pregnant Uterus: Sensibility, Irritability, Contractility, Retractility. Pajot has said, pregnancy does not create any new property. But the properties which the uterus already possesses are increased; for example, the organ is more sensitive and its nerves respond more readily to stimuli, or, in other words, its sensibility and irritability are greater. From its vast increase in size it is more exposed to the action of causes that affect these properties. The sensibility of the uterus varies in different subjects, and hence in some all active fœtal movements cause severe suffering, while others experience only a momentary inconvenience from such movements. The suffering caused by fœtal movements is often different in different parts of the uterus, in one severe, in another slight; the frequent repetition of movements referred to one portion of the uterus will there cause, in some cases, increasing distress. So, too, the irritability of the uterus is not the same in all; trivial causes in one woman will, from the great irritability of the uterus, excite contractions and lead to abortion, while another is subjected to the severest violence without interruption of pregnancy. Idiosyncrasy is supposed to explain cases of excessive sensibility, or of excessive irritability of the uterus; but in some instances at least the explanation is to be sought, not in a peculiar physiological, but in a positive pathological condition.

Consequent upon irritability is contractility, contraction is the response to irritation; contractility is manifested by shortening of muscular fibre followed by lengthening. The physiological irritability of

FIG. 98.

POSITION OF THE GRAVID UTERUS NEAR TERM, AND SOME OF THE RELATIONS OF THE INTESTINES.

a. Gravid uterus. *d*. Ascending colon. *e*. Kidney. *f, f*. Small intestine. *h*. Transverse colon. *i*. Liver. *i*. Diaphragm.

the uterus is manifested by the occurrence of contractions, which become more frequent as the pregnancy approaches its end; these contractions are painless, but as they gradually merge into the contractions of labor they become more frequent and are accompanied with suffering. Contractility is a property of all the muscular tissue of the uterus, but of course is greatest in those parts of the organ where this tissue is most developed. The painless contractions of pregnancy promote the circulation of the blood in the uterine sinuses, and also assist in fixing the fœtal presentation. The manifestation of contractility in labor will be elsewhere considered.

Retractility of the uterus has been defined as a property of the muscular tissue, by virtue of which the uterine walls tend to approach. It opposes distention, and is the antagonist of the elasticity which permits for the moment stretching of a part of the uterine walls. While contractility is a force manifested intermittently, retractility is constant in its action and permanent. It restores the form of the uterus, temporarily lost by fœtal movements or by changes of the mother's position; it keeps the uterine walls closely applied to the ovum, and after the detachment of the placenta it closes bleeding vessels, while during the puerperal state it prevents distention of the uterine cavity by blood-clots, and is one of the most important agents in promoting uterine involution. Contraction and retraction are two distinct nodalities of muscular action; neither is a condition, but each is a manifestation of muscular force.

Changes in the Neck of the Womb. Slight hypertrophy of the neck of the womb occurs in pregnancy; this part of the uterus is not so well supplied with blood as the body is, and is not subjected to the irritation from the growing ovum, at least until the latter weeks of pregnancy, and then the pressure of the ovum is chiefly at its upper portion, and hence its little increase in size.

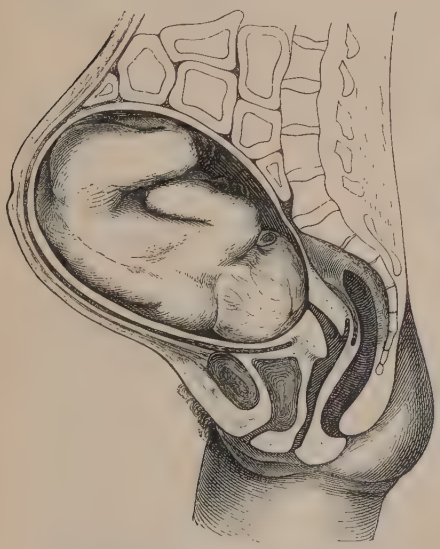
The position of the neck depends upon the position of the womb, and therefore, as the latter ascends into the abdominal cavity, the neck is drawn up and apparently shortened. Anterior inclination of the uterus causes the cervix, unless there be marked anteflexion, to point backward to the hollow of the sacrum; lateral inclination directs the neck toward that side of the pelvis opposite to the side of the abdominal cavity in which the fundus is; in primigravidæ the os uteri is usually found at the end of pregnancy quite far posteriorly and to the left of the pelvic cavity. In primigravidæ the virgin form of the neck is more distinct —that is, more plainly conical; but after a time, in consequence of the accumulation of the secretion of its glands in its canal, it is spindle-shaped. In the multigravidæ it is cylindrical or expanded at its lower portion so as to be club-shaped.

Softening of the Neck. Early in pregnancy a change in the consistence of that part of the neck adjoining the external os begins, and is manifested by the superficial tissues yielding to pressure. This softening is at first simply a continuation of that caused by the last menstruation; the softening advances regularly and slowly in the primigravida to the remaining portion of the vaginal cervix, so that, approximately, one-fourth is affected by it at four months, one-half at six, three-fourths

at seven, and the remaining fourth at eight months. In the multigravida the process is more rapid, because the neck is shorter and has been previously softened. The softening always begins below, thence passing above. It is attributed to a greater abundance of plasma, to hypertrophy and proliferation of fibre-cells, and, in the latter part of pregnancy, to blood-stasis caused by the pressure of the fœtal head in the lower portion of the uterus. The sensation that the finger receives by pressing upon the softened cervix has been compared to that which is given by similar pressure upon a piece of velvet placed upon a hard substance, at first a ready yielding to the pressure, and then a firm resistance. Softening of the neck is in the early months of pregnancy a valuable sign, which may assist in a probable diagnosis of the pregnant state.

State of the Internal and the External Os. In primigravidæ the external orifice of the womb remains closed until the end of pregnancy. In rare instances the finger can enter it, but usually for only a short distance, and in some of these possibly the penetration has been, not by an open canal, but from making it permeable by pressure. In still rarer instances the cervical canal in primigravidæ is permeable by the finger in the latter weeks of pregnancy, so that the fœtal membranes and presenting part may be touched; such cases are quite exceptional. In multigravidæ the external os is not surrounded by a regular smooth surface, but by a structure marked with irregular fissures; the cervical canal is open to a degree in direct relation with the period of pregnancy, the finger readily passing, for example, to the middle of the canal at seven months; the cavity thus entered by the finger is funnel-shaped, or the neck of the womb may be represented as a hollow cone, with its base below.

Fig. 99.



Schematic Section of a Primipara in the Last Month. (Schroeder.)

Fig. 100.

Schematic Section of a Multipara in the Last Month. (Schroeder.)

Shortening of the Neck of the Womb. The question as to shortening of the cervix became the subject of controversy nearly two centuries ago, and in quite recent years the contention has been greater than at any previous time. De Graaf, 1671, held that the cervix remained unchanged until the end of pregnancy, and the same view was maintained by Verhegen, 1710, and Weitprecht, 1750. Roederer, 1753, asserted that expansion of the cervical canal, contributing thus to the uterine cavity, advanced regularly from above downward during pregnancy, stating that this change could be noticed as early as toward the sixth month.[1] Stoltz, 1826, stated that the cervix was unchanged until the last fifteen days of pregnancy, and then the internal os opens, the cervical canal dilates from above downward, and the cervix is gradually effaced. Taylor, 1862, brought forward important observations to prove that the cervix did not shorten until the beginning of labor. In 1876 Bandl revived the teaching of Roederer, asserting that during the last ten weeks of pregnancy shortening of the cervix is in progress; the upper part of the cervical canal is dilated so as to form with the lower segment of the uterus the canal of Braun, or, as Tarnier calls it, the cervico-uterine canal. Bandl contended that the superior limit of the cervical canal, or the internal os uteri, could be demonstrated at the close of pregnancy or during labor to be at the level of the pelvic inlet.

While some have thus held that the lower uterine segment was cervical in origin,[2] others partly from the cervix and partly from the body of the uterus, the view now most generally accepted is, as expressed by Barbour,[3] "that no sufficient evidence has been produced that the lower segment, which resembles in its essential structure the rest of the uterus, is cervical in its origin; and until new evidence is brought forward we see no reason to ascribe to it an origin different from the rest of the wall of the uterus."

It would seem, however, that after effacement of the cervix at the end of pregnancy and the beginning of labor the cervical tissue must contribute to the lower portion of the completed uterine ovoid, which then presents a simple nearly circular opening and no canal.

Ribemont-Dessaignes and Le Page, op. cit, assert that the neck keeps its entire length during pregnancy, to the beginning of labor, and that the lower segment of the uterus to the end of pregnancy is formed not by the neck but by the inferior part of the body of this organ.

In regard to the changes of the cervix in pregnancy, Spiegelberg observed, it is no longer doubtful that the opening of the internal os uteri and the entering of the apex of the ovum into the cervical canal, thus causing this canal to contribute to the uterine cavity, are possible phenomena, and in fact do occur. Their occurrence is thus explained: In primigravidæ the lower portion of the uterus does not readily yield to the pressure of the growing ovum and to the uterine contractions, which become more frequent in the latter part of pregnancy, and hence the development of the cervical canal is more frequent in them, but the

[1] Although Kleinwächter refers impliedly to Roederer's views as indicating that the changes occurred in the last ten weeks of pregnancy, yet upon referring to Wrisberg's edition of Roederer's Elementa Artis Obstetriciæ, 1766, the time is stated to be *versus sextem mensem*.

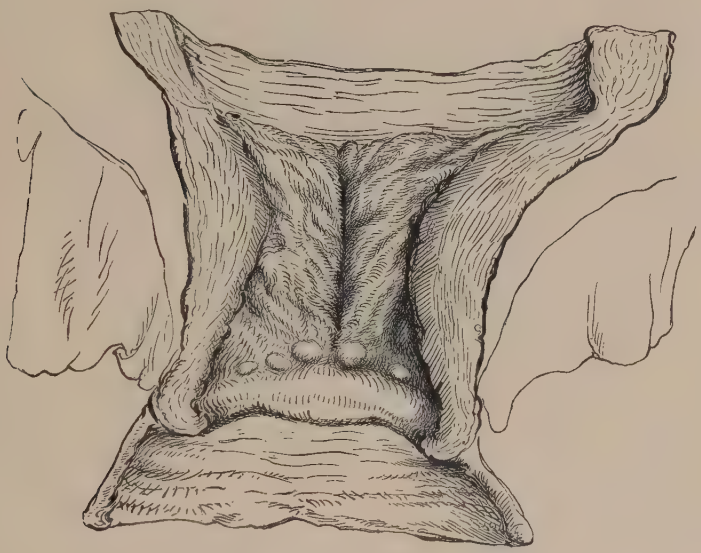
[2] According to this view, Bandl's ring is the dilated internal os uteri, the upper limit of the inferior segment, and Müller's ring is that which appears to be the internal os, the upper limit of the shortened cervical canal.

[3] The Anatomy of Labor. Edinburgh, 1889.

external os remains closed, or nearly so, until the end of pregnancy. On the other hand, in multigravidæ the lower portion of the uterus is less resisting, yields readily to the growing ovum, and therefore the internal os remains closed, not being subjected to so much pressure either from the ovum or from uterine contractions, and the finger can in these cases be passed further and further up the cervical canal with the progress of the pregnancy, the development of the canal being from below above.

Fig. 101 shows no shortening of the neck, but in the last two weeks of pregnancy, according to Stolz, Tarnier, and others, such shortening

FIG. 101.



CERVIX OF A WOMAN DYING IN THE EIGHTH MONTH OF PREGNANCY. (After DUNCAN.)

occurs in most cases; it is admitted, however, that this change may not occur until a few days, or even a few hours before labor begins. Taylor has more recently repeated his statement[1] as to the non-shortening of the cervix in pregnancy, and sustained it by additional facts and arguments.

Barbour's[2] conclusion from a study of "frozen sections" of women dying in pregnancy is that the cervical canal, lined by characteristic mucous membrane, remains of "pretty constant length." This view is that which is generally accepted.

When the neck has disappeared, been effaced[3] by being taken up into the body of the womb, the uterine changes of pregnancy are completed, and labor is at hand.

[1] Transactions Medical Society of New York, 1888. [2] Op. cit.

[3] Charpentier, by a strange confusion of language, as it seems to me, refers to the effacement of the neck as a phenomenon of pregnancy, but dilatation of the neck as a phenomenon of labor. But how, after it is effaced, can it be dilated? Dilatation of the os, but not of the neck, is a phenomenon of labor.

Changes in the Uterine Appendages. The broad ligaments have their peritoneal layers separated by the growing uterus, and as the organ ascends they are carried up by it; they share in the hypertrophy of the peritoneum covering the uterus. The ascension of the uterus compels a change in their direction, so that at the end of pregnancy they are vertical instead of horizontal.

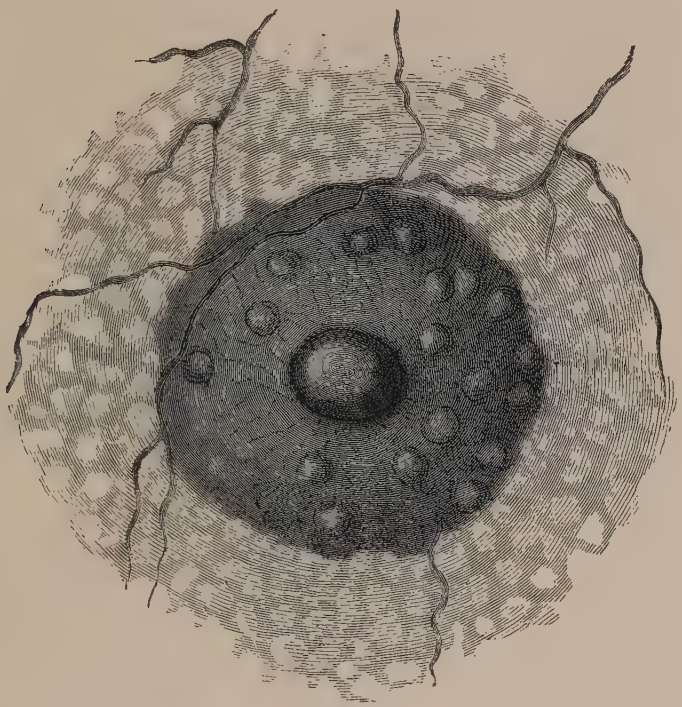
The round ligaments have their thickness increased fourfold; they become much longer, and at the termination of gestation extend from the vicinity of the umbilicus to the inguinal canal on each side; in consequence of the greater development of the posterior than of the anterior wall of the uterus, they are not directly upon the sides, but at the junction of the posterior four-fifths with the anterior fifth of the lateral borders of the uterus. The utero-sacral ligaments, the uterine retractors of Luschka, undergo remarkable development. The ovaries increase in size; according to Jacquemier, their size is doubled; they follow the movements of the broad ligament, and take nearly a vertical position. Ovulation in most cases, at least, is suspended, but the corpus luteum undergoes the changes which have been described as occurring in pregnancy. The oviducts also hypertrophy; their epithelial lining loses its vibratile cilia. Robin has stated that the canal of the oviduct contains a yellowish-white viscous matter, holding in suspension epithelial nuclei and fine fat granulations.

Changes in the Breasts. In some cases the mammary glands become larger at the beginning of pregnancy, but oftener this increase in size commences at the time corresponding with the first menstrual suppression following conception. Their enlargement is accompanied with increased sensibility, and occasional shooting pains are felt in them; the axillary ganglia may also be similarly affected. The superficial veins are larger and more distinct; if the increase in size of the breasts be very great, it is not unusual for striæ similar to those occurring upon the abdominal wall to be found about the fifth or sixth month. In some cases the enlargement lessens after four or five months, but reappears toward the end of pregnancy. The latter part of the second or third month the nipple is firmer, harder, more prominent, and sensitive; a milk-like fluid may possibly escape or be pressed from it, but this is not usually observed until in the last three months, and it may happen even in the absence of pregnancy.

Changes in the areola are more important and characteristic. These changes are swelling, development of the mamillary tubercles, and darkening of the entire surface. The first of these phenomena can usually be seen the second month; the swelling is not hard and tense, but puffy, giving to the finger the sensation of an emphysematous enlarged tissue. About the same time the areola becomes darker, and the hue deepens until the end of pregnancy, when in brunettes it is a dark brown, in some almost black, while in blondes this change is much less pronounced, and in the red-haired scarcely noticeable. The papular elevations, often called the tubercles of Montgomery, situated upon the areola, and regarded by some as miniature mammary glands, become much more prominent, projecting from the sixteenth to the eighth of an inch. The primary areola, which has a radius of about

an inch, three centimetres, is surrounded at the fifth or sixth month by a secondary areola; this is lighter in color, and flecked with whitish spots, presenting an appearance somewhat resembling that of dust-

Fig. 102.



The Primary and Secondary Areola in Pregnancy.

covered, white blotting-paper upon which drops of water have been sprinkled. The illustration (Fig. 102), from Depaul, very well represents the appearance of the breast in the latter months of pregnancy.

CHAPTER VII.

THE SIGNS AND DIAGNOSIS OF PREGNANCY.

Pregnancy is revealed by certain signs, and its diagnosis is made by their recognition and application. It is essential that the obstetric student faithfully study and clearly understand these signs, and then, by giving to each its true value and combining all, he will reach a correct conclusion. Van Swieten said that the physician's reputation was never more imperilled than in deciding as to pregnancy: "frauds everywhere, often everywhere snares prepared for the unwary." But not only may a mistake in diagnosis be very injurious to his reputation, it may ruin the reputation of one unjustly accused of being pregnant, or risk the health, or even the life of another affected by a disease simulating pregnancy; and this disease, thus neglected, may become incurable. That great mistakes have been made in the diagnosis of pregnancy—this condition asserted when it was absent, or denied when it was present—and that these mistakes have in some instances led to most deplorable consequences, is matter both of printed and oral history. Few practitioners of a dozen years' experience can truthfully say that no error in the diagnosis of pregnancy has ever been made by them. Pajot states that he could make quite a volume giving in detail the history of all the erroneous diagnoses in regard to pregnancy which have come under his own observation in an experience of thirty years; and these mistakes made, not by *sages femmes*, but by practitioners of more or less, some of them with very long, experience.

Now, there must be reasons for such great and comparatively frequent mistakes, and a brief exposition of some of these causes of error may help to avert the latter. Socrates said: "To attain to a knowledge of ourselves we must banish prejudice, passion, and sloth." These, too, must be banished when we study the practical diagnosis of pregnancy. Especially must we investigate a case without prejudice—that is, without *prejudgment*—whether the prejudice be from the opinion of others, or from the subject's previous history and her surroundings. That the judgment of another is in favor of or adverse to pregnancy must not rule our own; nor should our opinion be biased by the social position, reputation, and circumstances of the party; for some women, around whom apparently every safeguard has been thrown, may sacrifice their virtue, while others, less protected, preserve it in the midst of the strongest temptations. In this judicial inquiry the woman must be divested of all the accidents of life, of all her artificial surroundings, and simply considered as capable of reproduction. Her statements are to be received with great caution, for, on the one hand, a strong imagination will beget in her, if she ardently desires to be a mother, some of the signs of pregnancy; or, if she wishes to deceive, she may assert

them, and, if she wishes to conceal, she may deny them—yea, many a woman in the agony of childbirth, or in the very article of death, has denied her pregnancy with the vain hope of protecting her good name from reproach, or, more frequently, for the purpose of saving her seducer from exposure.

Ambition to give a prompt decision, or pride in opposing that of another, may lead to error. Rapidity is very far from proving correctness of diagnosis; here, as Lord Bacon has said of another matter, our intellects need not wings but weights of lead to moderate their course. The man of greatest knowledge least exalts his attainments, and is the most cautious and deliberate in judgment, and has respect for the opinions of others. Sloth may hinder or prevent our thorough investigation. We may be satisfied with a few facts instead of seeking all that are available. We may give undue weight to one or more of these facts, undervaluing or neglecting others. In illustration some cases that have been under my own observation will be given: A young lady of high social position, and against whose purity there was no whisper or thought of scandal, is attacked with obstinate vomiting. There is a denial of menstrual derangement; the vomiting resists all remedies, and she dies, but while dying a fœtus of three months and a half is expelled. A woman having passed twenty years of married life childless, some months after the menopause becomes pregnant; the pregnancy is suspected by one attendant, and denied by another. Nieden (*Cent. für Gebürt.*, 1889) gives an instance of pregnancy after twenty-six years of marriage (married at eighteen). The writer has had a patient who was ten years married before giving birth to a child; during these years her health was perfect, and there was apparently no reason for her delayed maternity. A girl who has never menstruated, and who does not fully present the other signs of puberty, becomes pregnant by violence, and gives birth to a child when she is twelve years old. A woman has menstrual suppression, coincident abdominal enlargement, the mammary and many other signs of pregnancy, but a post-mortem examination proves cystic disease of the ovary. A girl of twenty has never menstruated; her abdomen enlarges, her breasts are swelled and secrete; after a time severe uterine contractions occur, and a physician of large experience called to her during this attack declares she is in labor; the cause of the abdominal enlargement is accumulation of many months' menstrual secretion, and the uterine contractions simulating labor-pains are the efforts to overcome the resistance of an imperforate hymen.

Time would fail to give all the *published* cases in which a pregnant uterus has been tapped, or even abdominal section made for its removal, because it was thought an ovarian tumor, and many a patient has been saved from such perils because of the postponement of the operation until happily labor prevented its performance; the unpublished instances of such errors are much more numerous.

Pajot[1] states that he has seen a pregnancy of four months taken for an abscess, and the uterus opened by a bistoury, introduced into the vagina, by one of his old masters, the most learned and venerated. But

[1] Travaux d'Obstétrique et de Gynécologie.

it is not necessary to multiply instances of wrong diagnosis leading to an assertion of pregnancy when it does not exist, or a denial of it where it is present. Tardieu[1] has said that all signs of true pregnancy, except the *bruit* of the fœtal heart, may be observed when there is no pregnancy, from the development of the abdomen and breasts up to movements and the efforts of labor. It is not wonderful, then, that mistakes have been made, and yet in most cases they are avoidable.

Liability to error is caused by the pregnancy being abnormal, or by its complication with some pathological enlargement, for example, ascites, ovarian tumor, or uterine fibroid; but these topics will be considered elsewhere. Concluding the subject of diagnostic errors as to pregnancy, the practitioner who would avoid them must faithfully interrogate all the changes, both organic and functional, in the maternal organism, and those which are caused by fœtal development; he must be patient, thorough, painstaking in his investigation, not hasty, partial, and superficial; he must be willing to delay his decision in all doubtful cases, rather than run the risk of a happy guess, or trust an average of probabilities. Many other errors in diagnosis may never come to the light, but time is the certain and remorseless revealer of these; alike the asserted pregnancy which, like the weaving of Penelope's web, never ends, and the denied pregnancy which in a few weeks or months a babe's first cry contradicts, are too often made known, to the disappointment if not disgrace of the hasty diagnostician.

Classification of the Signs of Pregnancy. These may be conveniently divided into the *subjective* and the *objective*. The former include the information we can get from the person herself—all the answers she makes to our inquiries as to the functional changes caused by pregnancy, and as to the various new sensations she experiences; she tells us what she knows, or believes she knows. By objective signs, we mean those discovered by our own senses, the special avenues of certain knowledge; we may, or we may not, believe what another tells us, but that which we see with our own eyes, hear with our own ears, and handle with our own hands, commands our credence. The subjective signs will be considered first.

Menstruation is Absent. The absence of menstruation is a sign of great value in the case of a woman hitherto regular, there being no pathological cause for the suppression and no pathological result from it; the sign increases in value each month that it continues. But conception may occur during lactation, in the first nine or ten months of which menstruation is normally absent, or it may take place before any flow has been observed; as La Motte said, a woman may have fruit before flowers, and in such cases of course the sign is without value. Again, a monthly flow may occur once or oftener after conception, even continue during the entire pregnancy; and stranger still are those rare cases of this hemorrhage occurring in women only when pregnant. Naegele and Grenser,[2] referring to menstruation in pregnancy, state that sometimes the flow does not differ in type, quality, and quantity from ordinary menstruation. But the general law is that the pregnant

[1] Sur les Grossesses Fausses et Simulées.
[2] Traité Pratique de l'Art des Accouchements. Translated by Aubenas. Paris, 1880.

woman does not menstruate, and the apparent exceptions to this law are very few. Nature, when building up the fœtus, has no excess of material to be periodically discharged, and the intimate union which is established early in pregnancy between the ovum and the uterine mucous membrane prevents the latter being normally a source of hemorrhage, whether irregular or periodical. Further, ovulation is, as a rule, absent in pregnancy, and in like manner the associated or resulting hemorrhage ought to be absent. Hemorrhages from the uterus of a pregnant woman are pathological, not physiological, and generally threaten abortion or premature labor, and should be so considered and so treated. Rarely will one be deceived, says Stoltz,[1] who regards a woman menstruating regularly, with all the characters of menstruation, as not pregnant, while trusting the contrary opinion he is exposed to frequent errors.

Nausea and Vomiting—Salivation. Gastric disturbance is one of the most frequent symptoms of pregnancy, and in rare cases it begins about the time of conception. As illustrating the last statement, the following report of a case by the late Dr. Montgomery is of interest: "I attended a patient who was married on Monday, and began to be squeamish on Saturday; her delivery took place within nine months." If the nausea and vomiting be associated with menstrual suppression, if the disturbance occur at a regular time each day without any other pathological symptom, and if food is vomited soon after it is taken, and the appetite is unimpaired, this sign has great value. Copious secretion of saliva occurs in some cases, but it is not very frequent; it generally accompanies excessive nausea and vomiting, though it may also occur when these symptoms are absent or insignificant. The late Dr. Dewees attached great importance to spitting a white, frothy mucus—"cotton-spitting"—as a sign of pregnancy.

Nervous Disorders. Changes in the disposition, increased sensibility, despondency, etc., are of no value as signs of pregnancy, "for they are often just as great when a woman believes herself pregnant," the event proving her mistake, as when she is pregnant. The different forms of neuralgia from which pregnant women sometimes suffer may occur to the non-pregnant.

Mammary Pains and Swellings. Pains in the breasts and some enlargement of these organs, with possibly a slight secretion, will probably be observed by most women early in pregnancy, but all these symptoms may occur in girls and women who are not pregnant. Many females have more or less mammary pain and swelling in connection with menstruation.

Irritability of the Bladder—Leucorrhœa. It is not uncommon for women in the first part of gestation to have some irritability of the bladder and increased mucous discharge from the sexual organs. While inquiry may be made concerning these symptoms, but little importance is to be attached to them alone, for there are so many other conditions in which they may be found.

Quickening. Certain sensations perceived by the mother were believed to mark the time when the fœtus was endued with life and soul, and the woman was then "*quick* with child;" this distinction was

[1] Op. cit.

recognized alike by physicians and by courts. We now know that the child's life begins with the union of spermatozoid and ovule; then and there was the quickening power, then the true creation, and the young life in its dim dawn is as real and sacred as in its maturity.

The phenomenon commonly called quickening usually occurs between the first and the middle of the fifth month, but in rare cases it is noticed earlier, in others later, and in still others it is absent during the entire pregnancy.

Different opinions have been held as to its cause. By some it is attributed to the direct contact of the uterus with the abdominal wall. Tyler Smith believed the sensations due to the first peristaltic actions of the uterus, and regarded the date of quickening as marking the time when the contractile tissue of this organ is so far developed as to admit of these contractions. The opinion generally received is that it is caused by the movements of the fœtus that are first recognized by the mother; they are not felt until the uterus rests upon the abdominal wall, and they are felt through it, and not immediately in the wall of the uterus. Of course, fœtal movements are made much earlier, and they can be recognized by the stethoscope before the mother is conscious of them. The value of this sign of pregnancy is lessened not only by the fact previously mentioned, that pregnancy may be completed without the mother ever having been conscious of them, but by this, that, as Hamilton said, no woman ever yet fancied herself pregnant without persuading herself she felt the movements of the child. Nay, more, a woman after repeated experience as to the sensation in question may, with the best faith in the world, assert she feels these movements, and yet not be pregnant. Dr. Blundell[1] mentions a case under his own care of a woman who had given birth to twelve children, and who believed herself again pregnant, declaring she felt the movements of the child as plainly as she had in any of her previous pregnancies, and yet she was not pregnant.

The story of the supposed pregnancy of Queen Mary, of England, and that of Joanna Southcote, furnish illustrious instances of self-deception in regard to the sensation of fœtal movements.

Objective Signs. These are sought, not by inquiries, but by direct examination of the patient; they are not her statements, but facts and conditions directly recognized by our own senses.

Inspection. We observe the patient's countenance as to whether anxious, haggard, expressive of suspicion, or indifference; her face as to whether full and florid, or pale, thin, and emaciated, and as to the presence or absence of discolorations. When the patient is standing or walking it is well to notice the position of the shoulders, the increased lumbar curve, and the abdominal prominence. Examination of the naked abdomen may show striæ and pigmentation, and changes in the umbilicus, a deeper or effaced cavity, or umbilical pouting. The labia majora may be found swelled and firmer, and presenting greater or less discoloration, and the vaginal mucous membrane purplish. Nevertheless, visual examination of these parts is not necessary in most cases

[1] Principles and Practice of Obstetricy.

of supposed pregnancy. Exposure of one of the mammary glands is less trying to the subject, and furnishes more important information. Is the breast larger and firmer than usual? Is the nipple more prominent and harder, and can a fluid be pressed from it? The areola is to be closely observed as to whether swelled and darkened, and as to hypertrophy of its tubercles; supposing the primary areola to have undergone the characteristic changes of pregnancy, if the gestation has lasted five months, the secondary areola is beginning to appear. The urine may be examined as to the presence of kyestein, or as to the lessened quantity of its solid constituents; but such examination is of scientific interest rather than of practical value. Jorissenne's "sign" may be tried, the pulse counted when the woman is standing, then sitting, and, finally, when lying.[1]

TOUCH. The obstetric definition of touch is a digital or manual examination of the female internal and external generative organs and adjacent parts for diagnostic or therapeutic purposes. Touch may be vaginal, rectal, vesical, or abdominal. In the first three it is almost always digital, but in the last it is usually manual, and commonly called palpation; sometimes vaginal touch and abdominal palpation are combined, and this is bi-manual or abdomino-vaginal examination.

VAGINAL TOUCH. This is usually made with the index-finger of the right or of the left hand, whichever may be the more convenient with reference to the position of the patient; while the right hand is generally used, there are, as Cazeaux has said, some diseases of women and some positions of the fœtus which compel the accoucheur to use the left hand, and therefore he should accustom himself to touching with either hand. Some practitioners prefer to join the medius to the index, thereby gaining, according to Stein, a little more than half an inch, 15 millimetres; a gain of an inch is impossible. But if two fingers are used, the examination may be quite painful in a primigravida, and the sensation given the examiner by two fingers is less clear than that from one; beside, the index can be more easily separated from the adjoining finger, and thus can explore a greater part of the pelvic capacity.

Hubert, who happily characterizes the accoucheur's finger as *clairvoyant*,[2] states that in some localities in Holland accoucheurs and *sages-femmes* have for their sign a representation of a long finger surmounted by an eye. A similar device was placed by the late Dr. Valentine Mott upon the tickets of admission to his lectures in the University of New York.

The practitioner must carefully notice if there is the slightest abrasion upon the finger used in touching, or upon the other fingers of the hand, and if there be he should cover the abraded part with collodion or other protective material; if he neglects this precaution, he may, even

[1] Jorissenne (Nouveau Signe de la Grossesse) states that in the first months of gestation, in the absence or uncertainty of other signs of the pregnant condition, an important one is furnished by the fact that the pulse does not correspond with the changes of position, but remains the same whether the person is erect, sitting, or lying down. Fry (American Journal of Obstetrics, 1884) has not found this sign of any value More recently and from quite extensive observations, Louge (Le Pouls Puerpéral Physiologique) found the sign only occasionally present, and then after the fifth month, when other signs of pregnancy generally make the diagnosis quite easy.

Fry regards (op cit.) a vaginal temperature of 0.7° above that of the axilla as presumptive of pregnancy, if there is no fever or local disease.

[2] Cours d'Accouchements, professé à l'Université Catholique de Louvain, 1878

from a patient in regard to whom he has not the slightest suspicion of such disease, be inoculated with the poison of syphilis; many a physician in the discharge of his obstetric duties has become the subject of syphilitic infection from not taking proper precautions in a vaginal examination.

Subjective and Objective Disinfection. The thorough cleansing of the hands, especially of the fingers of which are brought in contact with the genital organs, is very important preliminary to an internal examination. The nails should be short and thoroughly cleansed. The hands are washed for five minutes in warm water and soap, a nail-brush being industriously used. Sänger's method, using green soap and sand, is excellent. After the washing the hands may be immersed in a solution of corrosive sublimate, one part to 1000, for two minutes. Then they may be dipped in a mixture of creolin and water, 3 to 5 per cent., or a solution of lysol, ½ to one per cent. The employment of creolin or of lysol renders unnecessary the application of any ointment to the examining finger.[1]

So far as objective disinfection is concerned, it would be better in all cases if the vagina be irrigated with a solution of lysol having the strength previously mentioned, or a creolin mixture, half a teaspoonful to one pint and a half of water. In some cases, those in which there is a purulent discharge, this previous irrigation is absolutely essential, and, indeed, in addition to one of the antiseptics mentioned, the vagina should be well washed with a solution of corrosive sublimate, one part to 2000.

Preparation and Position of the Patient—Examination. —The patient must have been further prepared by having the bowels and bladder recently emptied, and her clothing quite loose. The examination may be made when she is standing or when she is lying. If made in the former position, her back should be against the wall or some high, firm body, and the physician faces her, either sitting upon a low stool or resting one knee upon the floor—the right knee if the left index finger is used—the other knee furnishing a support for the elbow of the hand which touches. In the erect position the pressure of the intestines and the contraction of the abdominal muscles force the uterus somewhat lower; hence, in some women who are very fat, it is difficult to reach the os uteri if they are lying, and the examination may have to be made in the former position; so, too, this position is more favorable for vaginal ballottement. But in most cases the examination is made when the patient is lying. She should be on her back, lightly covered, the thighs and legs flexed; the bed should be of such firm material that her hips will not sink in it, or they should be raised by placing under them three or four thicknesses of blanket or a hair cushion. The physician now takes his seat or kneels by that side of the bed nearest which the patient is—if it be the right side, his right hand is used in the examination—extends the thumb and index finger, flexes the others, and introduces the hand under the clothes of the bed and of the patient,

[1] The question of disinfection will be further considered in connection with attendance upon labor.

touching the middle of the inner surface of the knee next him with the extended thumb, then by following a line parallel with, and equidistant from the thighs, his finger readily finds the vulval orifice, or this may be entered by first carrying the hand directly to the perineum, and then slightly raising the finger in the median line. Whichever plan of reaching the vulval opening is followed, it is very much better, the examination is easier, and the movements of the finger more free, if the forearm, instead of crossing beneath the thigh, is introduced under the clothing so far as to lie in a longitudinal direction. Some obstetricians advise passing the hand over the thigh of the patient, but this practice does not so well secure her immobility and relaxation of the abdominal wall; the latter is an important point if one failing to reach the os uteri, for example, or other part of which exploration is desirable, wishes to press, with the free hand upon the abdomen, the uterus toward the pelvic cavity. Before the finger is passed into the vagina the condition of the vulva may be learned, especially as to swelling from œdema, varices, or inflammation; it may be necessary subsequently to examine with the eye in case he finds such conditions. When the finger is passed into the vagina the state of this organ should be carefully noted as to size, temperature, secretion, sensibility, and form. Next the examination of the pelvis and uterus is made. Of course, any considerable encroachment upon the pelvic diameters by a new growth or by change in the bones could be readily ascertained. Such pathological growths and deformities are rare exceptions, and the physician's constant and generally only concern is the condition of the uterus. His first effort is to find the os uteri, and this is not in all cases easy to do. Remembering the usual right antero-lateral position of the body of the uterus in pregnancy, the os would be directed backward to the sacral cavity and to the left side; it may be impossible to reach it while the patient is lying upon her back; nevertheless an effort should be made, first having her hips still more elevated, and by pressing, with one hand upon the abdomen, the uterus backward and toward the median line; if this fail, the woman is directed to turn upon the side opposite to that of the latero-version, the finger during this change of position being retained in the vagina, and generally the os uteri may then be felt. The changes in the cervix and os caused by pregnancy have previously been stated, and therefore no further reference to them is necessary.

Sänger's Sign. Sänger has called attention to the condition of the ureters in pregnancy as felt by vaginal examination. They are more prominent, larger, and more resistant. Certainly those who have had the opportunity of making this examination under his direction must be impressed with the value of this sign of pregnancy.

Examining the Body of the Uterus. Examination of the body of the uterus, as far as it can be reached by the finger in the vagina, assisted by pressure upon the abdomen, is made; if the organ has changed its form so that the finger passes somewhat abruptly from the nearly cylindrical cervix to a round, expanded body, and if its walls are elastic, depressible, and yielding, the probability is, the uterine enlargement is caused by pregnancy. This sign is one of the earliest that is available,

and one which, if not deserving to be ranked among the certain signs, yet gives a high degree of probability.[1]

Ballottement. In obstetrics this word means the sensation which the examiner experiences when he communicates a sudden movement to the whole or to a part of the fœtus; repercussion is sometimes used as a synonym. It is the result of a momentary displacement of a solid body in a liquid; just as one by striking a lump of ice[2] in a tumbler of water with the finger causes it to recede—and the experiment would be the same if a finger-tap were made through a membrane fastened over the tumbler—so an impulsion is made upon the fœtus or a part of it. If the entire fœtus be displaced, and the finger be retained at the point where this movement was produced, the return of the fœtus may also be recognized, and the sensation thus caused is known as the *choc de retour*. It is thus seen that there may be a single sensation experienced in ballottement, and this is the more frequent, or a double sensation.

Ballottement is either abdominal or vaginal; the former will be considered hereafter. In vaginal ballottement the woman is either standing or lying. The physician should, in the former case, pass one or two fingers into the vagina, and in front of the cervix, until they rest upon the body of the womb at its junction with the former; the free hand is applied to the fundus of the uterus, and then a quick movement is made by the finger or fingers in the vagina, a sudden impulse thus communicated to the fœtus, dislodging it from its position and causing it to float upward in the uterine cavity; the return of the fœtus may be felt in many cases, that is, unless this return be very gradual, or in those cases in which only a part of the fœtus has been displaced. If the woman be lying, it is well for her to have the head and shoulders somewhat raised, so as to throw the uterus forward, and then the ballottement may be sought just as if she were erect; if she be quite horizontal, the finger must be passed into the posterior, instead of into the anterior, cul-de-sac.

Ballottement is an almost positive proof of pregnancy; nevertheless, Pajot found it present in a woman who was not pregnant, but had a multilocular ovarian cyst. The absence of ballottement does not prove that woman is not pregnant; for great size or small size of the fœtus, plural pregnancy, polyhydramnios, placental or shoulder presentation may prevent it. A ballottement caused by entire displacement of the fœtus, though recognizable at about five months, is best perceived in the sixth and seventh months, and that from a partial displacement later. But before the date when ballottement is readily done signs of pregnancy are available which are certain.

Rectal and Vesical Touch, Hegar's Sign. Rectal touch may be necessary in case of vulval or of vaginal obstruction, in posterior displacements of the uterus, and in the diagnosis of tumors of the recto-vaginal wall, of effusions in Douglas's cul-de-sac, and of extra-uterine

[1] Before attempting the certain diagnosis of pregnancy in the first months it may be well to recall the caution which Dr. Wm. Hunter manifested: "I cannot determine at four months; I am afraid of myself at five months; but when six or seven months are over, I urge an examination." Of course, this is extreme, for it is only in exceptional cases that a positive diagnosis cannot be made in the fifth month.

[2] Tarnier.

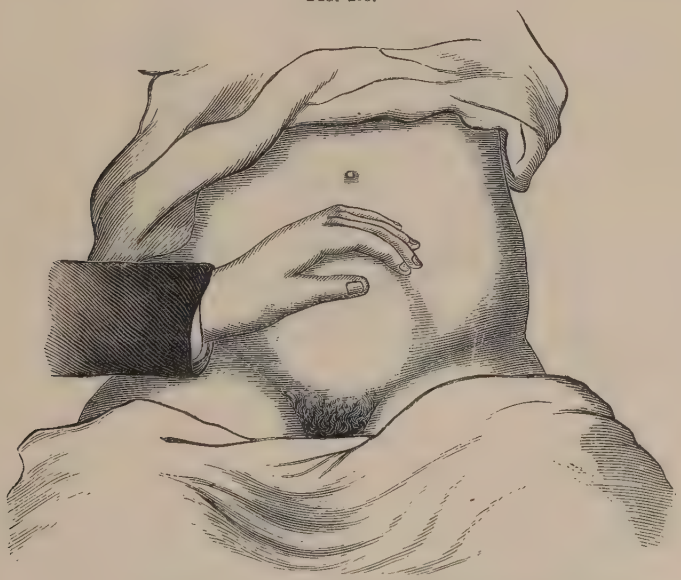
pregnancy. It is a method of examination very repulsive to the subject, and is rarely necessary. Vesical touch or examination through the bladder, the urethra having been previously dilated to admit the finger, permits examination of the anterior wall of the uterus; it is rarely required.

The sign of pregnancy known as Hegar's, is softening and thinning of that part of the uterus immediately above the cervix. This condition may be recognized by introducing the index finger of one hand into the rectum above the utero-sacral ligaments, pressing directly upward, the patient lying upon her back; three fingers of the other hand press firmly upon the abdominal wall just above the pubes, so that they are brought in approximation with the rectal finger: the thinning of the lower portion of the uterus is thus discovered.

Sonntag[1] has published fifty cases in which diagnosis of pregnancy was made by Hegar's sign. But for this examination anæsthesia is usually required, and, moreover, in some instances it has been followed by abortion. Diagnosis in the second or third month of pregnancy can only exceptionally be necessary.

Abdominal Touch, or Palpation. This consists in the application of the hands to the abdomen for the diagnosis of pregnancy and

Fig. 103.



The Hand Circumscribing the Fundus of the Uterus in Palpation.

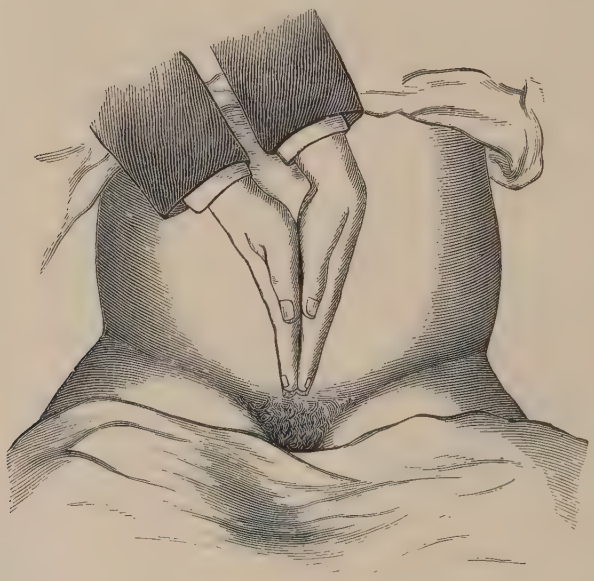
its duration, to ascertain whether it be single or plural, the presentation and position of the fœtus, and for the correction of an unfavorable presentation.

The woman, her bowels and bladder having previously been evacuated, lies upon her back, with her limbs extended; the abdomen is

[1] Das Hegar'sche Schwangerschaftszeichen, Leipzig, 1892.

exposed from the epigastrium to the mons veneris. The physician, having previously warmed his hands if they are cold, takes his position at that side of the bed nearest which she is lying—the left is the better—and places one of his hands upon the hypogastrium, keeping it pressed there flat and with moderate firmness for two or three minutes in order to accustom the abdominal muscles to this contact, and thus obviate their contraction. So, too, if the pregnancy be well advanced, uterine contraction may be excited by the hand; during it all pressure should cease. The first object in palpation is to learn the presence and the size of the uterus, and to do this let the left hand, if the physician is upon the patient's right side, be pressed with the fingers and thumb slightly flexed so as to correspond to the convex surface of the uterus upon the hypogastrium, and gradually carry the hand further up the abdominal wall, each movement of ascent marked, first, by relaxed, then increased pressure, and the pressure being stronger at the ulnar margin of the hand, so that when the fundus of the uterus is reached that part at once

Fig. 104.



recognizes the failure of resistance and dips deeper in the abdominal cavity. Another method is by using both hands held almost vertically so that the fingers begin pressing upon the hypogastrium in the median line, then the hands are gradually separated, the space widened between them until the fingers meeting with no resistance may be passed down on each side of the uterus; the sides of the uterus can now be followed up until the fundus is reached. We recognize the uterus by its form, by its position, and possibly by its being the seat of intermittent contractions; further in cases of doubt, while one hand circumscribes the supposed fundus, a finger of the other may be passed into the vagina, so as to touch the cervix, and the continuity of this with the mass felt

through the abdominal wall can be easily ascertained. The distance of the fundus above the pubic symphysis, supposing the woman to be pregnant, enables an approximate determination of the time of the pregnancy.

Intermittent contractions of the uterus ascertained by palpation have been especially studied by Dr. Braxton Hicks, and he states that this sign is available by the last of the third month.[1] "If then the uterus be examined without friction or any pressure beyond that necessary for full contact of the hand continuously over a period of from five to twenty minutes, it will be noticed to become firm if relaxed at first, and more or less flaccid if it be firm at first. It is seldom that so long an interval occurs as that of twenty minutes; most frequently it occurs every five or ten minutes, sometimes even twice in five minutes. However, in some cases, I have found only one contraction in thirty minutes. The duration of each contraction is generally not long; ordinarily it lasts from two to five minutes."

Dr. Hicks has also stated,[2] referring to this method of examination: "If we find a tumor changing in density and hardness, we have an assurance that it is the uterus." But Tarnier has called attention to the fact that a distended bladder gives the same sensation of intermittent contractions, and the experience of others can give confirming proofs; so, too, according to Matthews Duncan, contractions quite as distinct may be observed in case of a soft fibroid of the uterus, and with as much change of shape as a pregnant uterus: the first source of error would, of course, be readily avoided by the use of the catheter.

At five months the walls of the uterus have become so elastic and depressible, and the fœtus is sufficiently developed to be recognized by palpation if the abdominal wall be not too thick; in this examination some parts of the uterine globe are harder, more resisting than others which are elastic, and permit depression. As pregnancy advances an indistinct fluctuation may be found, and if the uterus is embraced by the hands at its sides, by pressing these alternately the fœtus, or parts of it, may be moved toward one and then toward the other. This is known as abdominal ballottement.

Passive movement of the fœtus may also be made by pressing with a single hand upon some portion of the uterine globe where there is felt a special resistance, that resistance coming from part of the fœtus, and the pressure forcing it momentarily away.

Spontaneous movements of the fœtus are almost certain to occur during abdominal palpation; when they are being made the hand should be kept immobile, but closely applied to the abdominal wall. These movements may be recognized as early as the last of the fifth or the first of the sixth month. They may be general or partial; in the former case the entire body changes its position, and a general change in the form of the uterus temporarily occurs; the movement is gradual, gliding or rolling, and is slow. The partial movements are those of the head or of the members; they are quick, local, as if of sudden taps or blows given at a particular part of the internal uterine wall, and causing the uterus at that part for an instant to change its form.

[1] Transactions of the London Obstetrical Society, vol. xiii.
[2] Transactions of the International Medical Congress, 1881.

Active movements of the fœtus are most frequently observed in the morning after the woman's rest, at least they are then most pronounced. Of course, if the obstetrician recognizes such movements, he has not only positive proof of pregnancy, but also of the fœtus being alive. But the inability to perceive these movements, or their absence, is not a proof that the woman is not pregnant; for the feebleness of the child, or excess of liquor amnii, may cause this sign to be absent. Or, again, contractions of the abdominal muscles, or movements of the intestines, may be mistaken, and have been so mistaken by even celebrated observers, for movements of the fœtus. He, therefore, will act most wisely who avoids possibility of error by repeating once or oftener this examination, and also confirms the results obtained by touch by those given by sight—that is, both feels and sees the movements of the fœtus. It is, moreover, fortunate that he is not restricted in deciding as to pregnancy by a single sign, but can combine others with it.

In many cases at the end of the sixth or the beginning of the seventh month different parts of the fœtus, as the head, breech, or limbs, may be recognized by abdominal palpation. Nevertheless a tense, resisting abdominal wall, or one that is very thick, may render this recognition impossible.

The late Dr. Albert H. Smith,[1] of Philadelphia, advised in certain cases the following method of "external bimanual ballottement:" The woman is placed upon the edge of the bed with her clothing removed from the abdomen, and then rolled upon her side; so that the anterior abdominal wall projects over the edge of the bed; then the rotation of her body is carried still further until the enlarged uterus becomes so dependent that it may be supported by the hand placed beneath it, while the other hand makes counter-pressure upon the opposite side of the uterine mass. Thus let the woman be upon her left side, the right side, therefore, being above, the examiner takes his seat with his face toward her head, his left side being toward the pendent abdominal mass, but about opposite the hips. The right hand is then passed far under the uterus as it projects over the bed, the palmar surface being in contact with the abdominal integument and the ulnar edge toward the iliac bone. The left hand is thus placed similarly upon the right side of the abdomen, making counter-pressure upon the opposite side of the uterine body so as to grasp it between the two palms. This gives a full command of the tumor, and enables the examiner to appreciate the shape and density of the mass, its fluctuating character, and the movement of a separate body within it, which can be operated upon by manipulation and re-percussion." Dr. Smith further stated that by this method he has been "able to diagnose a pregnancy of six months when the fœtal heart was entirely inaudible."

In another part of this paper its author said that even at three months and a half it is sometimes possible, if the uterine wall be thin and soft, to feel the movements of the child by a finger pressing firmly upon the uterus posteriorly to the neck, while the other hand makes counter-pressure through the abdominal wall upon the anterior and the

[1] "Manual Examination in the Diagnosis of Pregnancy." A paper read before the Philadelphia County Medical Society.

superior surface of the uterus; and further, "by a gentle thrust of the vaginal finger upward, to feel the receding and return of a body loosely floating in a liquid;" during this abdomino-vaginal manipulation the woman is lying upon her back.

Obstetric Auscultation. Laennec's treatise upon *Mediate Auscultation* was published in 1816, and two years later Mayor, of Geneva, stated that upon applying the ear to the abdomen of a pregnant woman the pulsations of the fœtal heart could be heard, and he thus made known one of the most important discoveries in obstetric science. Kergaradec, of Lausanne, ignorant of Mayor's priority in the discovery, announced the same fact in 1821. The discovery was an accident to each; neither was listening for what he heard; Mayor listened, hoping to hear sounds caused by movements of the fœtus, and Kergaradec those occurring in the amnial liquor from these movements.

Kergaradec, beside hearing the pulsations of the fœtal heart, heard a sound attributed by him to the circulation in the placenta, which he therefore called the placental souffle. As will be shown hereafter, his theory of the origin of this souffle was erroneous; the souffle is not connected with the placental circulation, and therefore the name given it was incorrect.

In addition to the two sounds mentioned, other sounds are discovered by obstetric auscultation: those caused by fœtal movements, a cardiac souffle, attributed to the passage of blood through the foramen of Botal, and a funic souffle;[1] but they are of minor interest, and the two sounds first discovered are of chief importance.

Obstetric auscultation is usually abdominal, but it may be vaginal; Nauche, at the suggestion of Maygrier, devised an instrument called the metroscope for auscultating through the vagina. The objections to vaginal auscultation are its difficulty, the unwillingness of patients to submit to it, and when the instrument is applied to the fundus of the vagina, or in the cavity of the uterine cervix, great irritation, causing abortion, may be produced. Nevertheless it has recently been revived by Verardini, of Bologna, who by this means has been quite successful in diagnosing early pregnancies. Abdominal auscultation should be mediate for these reasons: The direct application of the ear to the abdomen is indelicate; pressure upon a great extent of surface, causing *bruits* from muscular contraction, is necessary; it demands a constrained position on the part of the observer, and it is not possible thus to auscultate some parts of the abdomen, and the want of cleanliness on the part of some patients may make it very objectionable to the examiner.[2] A stethoscope is less trying to the patient and to the doctor; it permits examination of parts that cannot be reached by the unarmed ear, and the sounds heard through it are better defined and their limit better determined. The stethoscope should not be less than six inches, about 15 centimetres, long. The woman should lie upon her back, with her

[1] The funic souffle, discovered by Kennedy in 1833, is a blowing sound synchronous with the fœtal heart, and, according to Winckel, is heard in three-fourths of all cases. This observer also states that in 33 per cent. of all the cases in which it is heard the cord is abnormally short, or long, and that in 8 per cent. the children perish. The sound is, as a rule, heard over the child's back, and near the heart.

[2] Nevertheless, if failure occur using the stethoscope, immediate auscultation may be employed.

limbs extended or only slightly flexed. In the course of the examination it may sometimes be necessary for her to turn upon one or the other side, but the examination will be made chiefly without change of position. In some cases, from motives of delicacy, the abdomen may be kept covered, and a single thickness of thin unstarched material will not, as a rule, materially interfere with hearing the sounds sought; but, as Depaul advises, in all cases of doubt or difficulty the abdomen must be naked.

Uterine Souffle. Upon applying the stethoscope to the abdomen of a woman some five or six months pregnant, or more—according to Spiegelberg, it may be audible at four months—probably the first sound heard is that which was originally called the *placental souffle*, and which some physicians of to-day still thus miscall; it is properly termed the *uterine souffle*. That the placenta has nothing to do with the production of the sound in question is proved by the fact that it may be heard two or three—in some cases five or six—days after labor. Since this souffle may be heard several days after labor, it is plain that when heard during pregnancy the place at which it is most distinct does not indicate the site of placental attachment. Beside the placental theory of this sound, it has been attributed to an impoverished condition of the blood, to pressure of the gravid uterus upon the iliac arteries and upon the aorta, more recently by Glenard at first to the circulation in the epigastric and then to that in the "puerperal" artery.

The theory of its origin which is now most generally accepted is that of Dubois, somewhat modified by Depaul.[1] The sound is heard most distinctly at the sides of the uterus where the blood-supply of the organ is received; the arteries upon entering the uterus immediately dilate, offering permanently a capacity which seems too great for the blood they have to receive. This disproportion, which does not naturally exist in other parts of the organ, may nevertheless be produced under the influence of different causes whose action is transient and varying from one minute to another. Among these causes the most common are those which result from compressions caused by projections of different parts of the fœtal ovoid. Thus it happens, in correspondence with these changes, there are changes in the uterine souffle which may be heard distinctly one minute at a particular part of the uterus, and then instantly cease. The sound is single,[2] without shock, is synchronous with the mother's pulse, and resembles the souffle of a varicose aneurism; it varies in character and in distinctness; it may be sibilant, or humming, or sonorous; it has been compared to the sound made by saying in a low tone *voo*. It is best heard when the stethoscope is applied to the lower lateral parts of the uterus; it is usually first recognized in the fifth month, but Depaul heard it in the tenth week, Spiegelberg from the eighth to the ninth, as did also Verardini.

From the explanation that has been given of the cause of this sound it can readily be understood that whenever the uterus has a notably increased supply of blood the uterine souffle may be heard; thus it has

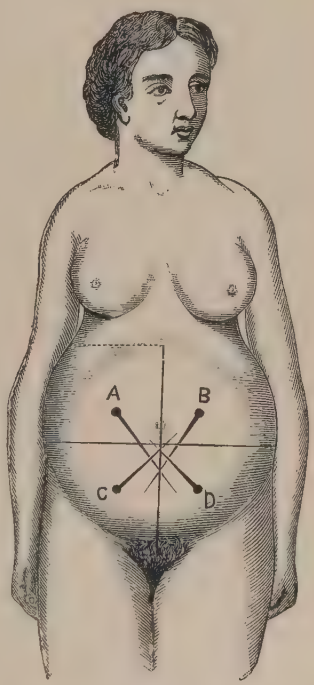
[1] Dictionnaire Encyclopédique des Sciences Médicales.
[2] Winckel believes that the murmur is not only intermittent, but may be continuous; in the former case being arterial and in the latter venous.

been found in some cases of large uterine fibroids. As a sign of pregnancy, therefore, it has little value; taken in connection with others it adds strength, but must not be relied upon alone. Even if the pregnant state be known, this sound gives no information as to the condition of the fœtus, for its death makes no change in the souffle.

Sounds of the Fœtal Heart. These sounds have been very generally compared to the *tic-tac* of a watch put under a pillow upon which the ear is placed. The first sound is the more distinct, and corresponds with the pulsation in the umbilical arteries; the interval between the two sounds is less than that between the double pulsations, or, as one may say, it is twice as long between a *tac* and a *tic* as it is between a *tic* and a *tac*, and this difference may be thus expressed, *tic-tac—tic-tac*.

Depaul in several cases heard these sounds at three months and a half, and in one at the latter part of the third month.[1] "At the end of the fourth month the cases in which auscultation is uselessly practised are much more rare, and they become so much more exceptional as women are nearer the term." In 906 pregnant women examined by Depaul, the sound of the fœtal heart failed to be heard but eight times, and some of these failures, he states, are to be attributed to another cause than the powerlessness of auscultation.

Fig. 105.



Different Parts of Abdomen for Auscultation.

In listening for these sounds the stethoscope should be applied up to four months to the fundus of the uterus, and in a line corresponding with the axis of the inlet. With the ascension of the uterus in the abdominal cavity the instrument must usually be placed upon one or the other side, though sometimes the sounds are more distinct in the median line. During the last three months of pregnancy the sounds are, in the great majority of cases, most distinctly heard at the middle of a line drawn from the umbilicus to the left anterior superior spinous process; failing to hear them here, the physician should next listen at a corresponding point upon the right side; if the sounds cannot be heard at either of these points, the stethoscope should be applied above the umbilicus, upon one, then, if necessary, upon the other side of the median line. The following illustration, from Depaul's *Clinique Obstétricale*, shows these different points. The examiner first applies his stethoscope at D; if he fails to hear the sounds at this point, or hears them only indistinctly, he next listens at C; finally, he tries the points

[1] Depaul, op. cit.

A and B, if no satisfactory result has been obtained by auscultating at D or C.

The pulsations of the fœtal are much more frequent than those of the maternal heart, and vary from 120 to 160 a minute, the mean being 140; these pulsations vary in the same fœtus as to frequency, becoming slower or faster from one time to another. The distinctness with which they are heard will of course depend upon the size and development of the fœtus, and upon its position, upon the quantity of liquor amnii, and the thickness of the uterine and of the abdominal walls. The frequency of the pulsations is uninfluenced by the mother's circulation, but it is by her temperature, increasing as that increases.

Important movements of the fœtus, whether spontaneous or resulting from external causes, are followed by an acceleration of the pulsations, while these become slower at the height of a uterine contraction. Exceptionally, Kaltenbach states, the impulse of the heart is palpable.

Other Sounds Heard in Abdominal Auscultation in Pregnancy. Olshausen attaches much importance to the recognition by the ear of fœtal movements, stating that they may be heard in the latter part of the fourth month, and therefore usually before the sounds of the heart are audible.

Fœtal Shock, Choc Fœtal of Pajot. Toward the end of the first half of pregnancy if the stethoscope is applied to the abdomen, pressing but gently, the examiner perceives a double sensation of slight shock and a bruit from a movement of the fœtus. Pajot claims that this sign, thus addressing general and special sensibility, is more readily recognized in the existing period of development than are the sounds of the fœtal heart, and in many cases are heard earlier.

Funic Souffle. The funic souffle, discovered by Kennedy in 1833, is a blowing sound synchronous with the fœtal heart. Winckel states that it can be heard in three-fourths of all cases. In 33 per cent. of cases the cord was unusually short, or abnormally long; it is heard ten times as frequently in velamentous insertion; tension, pressure, and displacement are its chief causes. Ettinger's conclusion[1] is that the funic souffle is caused by compression of the vessels, chiefly from coils, true knots, or shortness of the cord.

Runge remarks that in very rare cases congenital valvular defects of the heart may manifest their existence in pregnancy, continuing during it, and also audible after birth, producing a sound similar to the funic souffle.

Prediction of Sex. It has been held that there is a relation between the frequency of the pulsations and the sex of the fœtus—Frankenhauser, and others—while Cumming maintained that this frequency depended upon the weight of the child. Danzats states that if the pulsations are more than 145 a minute the probability is in favor of the child being a female, under 135 a male, and between these numbers a prediction cannot be made. Hennig and Ziegenspeck found the average frequency of the pulsation of the heart of the male fœtus 136, and that of the female 139; this difference is so small that, as Winckel

[1] Inaugural Dissertation, Zurich, 1888.

remarks, it is seldom possible to predict the sex, and this expresses the general opinion of the profession. Some, however, differ. In this country Professor Frank C. Wilson, of Louisville, Ky., has for some years given much attention to the subject, and his conclusions are here presented.

LOUISVILLE, Ky., July 14, 1884.

PROF. TH. PARVIN,

DEAR DOCTOR: In reply to yours of 10th inst. I would say that with a reasonable degree of accuracy the sex may be predicted from the rapidity of the fœtal heart sounds. These vary from 110 to 170 per minute, and 134 may be taken as the dividing-line, above which the sex will be female, and below which the sex will be male, the certainty increasing the further you recede from the dividing-point. The following rules I have found useful in determining the sex:

From 110 to 125	the sex will be,	almost certainly	male
" 125 to 130	"	"	probably male.
" 130 to 134	"	"	doubtful with chances in favor of male.
" 134 to 138	"	"	" " " " female.
" 138 to 143	"	"	probably female.
" 143 to 170	"	"	almost certainly female.

Although failures occasionally occur, they are not numerous.

Very sincerely yours,

FRANK C. WILSON.

Certainly, in view of the statements of Dr. Wilson, who is one of the most careful, competent, and conscientious observers, the subject is deserving of further investigation.

My young friend, Dr. Charles H. Reckefus, has recently been giving considerable attention to the study of the possibility of predicting the sex from the rate of the pulsations of the fœtal heart, and in February of this year, 1895, he has furnished me the following statement: "Using 134 as the dividing-line, I found out of 66 cases the prediction as to sex correct in 49 instances, incorrect in 17."[1]

[1] Dr. Ross, of Belfast, makes the following statement in the British Medical Journal, July, 1891: "If I find the mother describes the fœtal movements are felt chiefly and most distinctly on the left side, I emphatically predict a male birth: if on the right, I as surely determine the sex to be female."

CHAPTER VIII.

THE DIAGNOSIS OF PLURAL PREGNANCY—DIFFERENTIAL DIAGNOSIS OF PREGNANCY—DIAGNOSIS OF PREVIOUS PREGNANCY, OF PERIOD OF PREGNANCY—DURATION OF PREGNANCY—DATE OF LABOR—PRECOCIOUS BIRTHS—PROLONGED PREGNANCY—MISSED LABOR.

Diagnosis of Twin Pregnancy. In the great majority of cases this is not made until after the birth of the first child; indeed, Capuron[1] thought that certain proof could only then be had; in this, however, he was mistaken, as will be hereafter shown. Yet the diagnosis is by no means always readily made, and in most cases the obstetrician must be content with a probability instead of attaining a certainty.

The signs of a plural pregnancy[2] are conveniently divided into probable and certain. Among the former are extraordinary enlargement of the abdomen, the size being greater than in correspondence with the period of pregnancy; unusual form of the abdominal prominence, the uterus being developed more in its transverse than in its vertical diameter; lateral is more marked than median projection, so that in some cases, as Mauriceau stated, there is a depression directly in the median line, and "an eminence on each side of the abdomen;" fœtal movements observed at different parts of the abdomen, these movements being more frequent and stronger than usual; and finally, the disorders of pregnancy are more decided than when only one fœtus is present; there is also greater liability to premature labor.

The venous circulation is seriously interfered with by the great development of the abdomen, and hence œdema of the lower limbs and of the abdominal walls. Depaul attached some importance to an œdematous swelling, triangular in form, having its base at the pubes, and its apex pointing toward the umbilicus, as indicative of a plural pregnancy.

Diagnosis by Palpation. The certain signs of plural pregnancy are given by vaginal touch, abdominal palpation, and by auscultation. Vaginal touch may, after labor has begun, furnish the evidence of a twin pregnancy; thus, it is possible there may be recognized, as was done by Depaul in two cases, a furrow dividing the protruding bag of waters into two parts, indicating the presence of two fœtal sacs; Charpentier states this sign was first made known by Dugès and Madame Lachapelle. The cases are rare in which it is present. In consequence of the relatively less quantity of liquor amnii, and of the fact that the uterine cavity is so largely occupied by the fœtuses, passive movements

[1] When almost eighty years of age, and after having been a teacher of obstetrics for nearly fifty years, he one day said to Pajot: "My friend, there is but one way by which you may certainly know a twin pregnancy. If you have seen one fœtus born, and find there is another in the uterus, you may be sure there are twins."

[2] Mr. Rigby, at the age of eighty, was the father of four children at one birth. Gooch's Compendium.

of these, or abdominal ballottement, cannot be so readily made; and, on the other hand, if the very great uterine enlargement be caused by polyhydramnios, the mobility of the fœtuses is greater than is normally present. Again, there is, as expressed by Pinard, a permanent tension of the uterine wall in case of plural pregnancy. "This wall, instead of being easily depressed, is tense and resisting; it gives a sensation similar to that caused by pressing upon a rubber bag distended by air or by a liquid." Next the presence of fœtal members in different parts of the uterus may be sought, and then the two fœtal poles in the upper and two also in the lower portion of the uterus conclude the diagnosis of twin pregnancy by palpation. By this means Pinard discovered in thirty-two cases the presence of twins in the uterus. He also diagnosed triplets between the fifth and sixth month of pregnancy; he found three heads, one in the pelvic cavity, a second in the right iliac fossa, and a third above and near the median line.

It is well not to entertain too great confidence in this method of diagnosis, and therefore not to be disappointed by at least occasional failures; indeed, Depaul regarded it as only exceptionally possible, as the following passage indicates: "Some practitioners in fact teach that one can distinguish through the abdominal walls two fœtuses. The necessary conditions for such a diagnosis are only very exceptionally presented, for in multiple pregnancy the uterine and abdominal walls are usually tense, and can only with pain and difficulty be depressed by the hand of the examiner. Besides, it is much less easy than is generally thought to distinguish the different regions of the fœtus through the abdominal and uterine walls, and when you wish to apply palpation to the diagnosis of presentations of the shoulder and of the pelvic extremity you will recognize how much the hips, by their roundness and resistance, offer, through the walls which separate them from the hand, resemblance to the cephalic extremity."

Diagnosis by Auscultation. Kergaradec was the first to point out the possibility of recognizing a twin pregnancy by hearing the sounds of two fœtal hearts. Subsequently, however, others regarded the supposed placental *bruit* as giving this proof, for indeed, according to the original theory as to the origin of this sound, it would be heard at two different points corresponding with the situations of the two placentæ. But this view, according to which the sound referred to resulted from the circulation in the utero-placental vessels, being, as has been previously shown, an error, of course a correct diagnosis could not be founded upon it. We return, therefore, to the original suggestion of Kergaradec, and find that the "double pulsations of the fœtal heart, heard at two different points of the uterus, with a maximum of intensity and without isochronism, show the presence of two fœtuses in the uterine cavity." In making this examination care should be taken to exclude any error which would arise from confounding the sounds of the mother's heart with those of a fœtal heart. In order that the diagnosis of twins can be correctly made by auscultation, the obstetrician must hear fœtal heart-sounds most clearly at different parts of the uterus, in neither case isochronous with the mother's pulse, nor isochronous with each other. The variation in frequency between the heart-sounds of two fœtuses may be only six or eight, or

[1] Leçons de Clinique Obstétricale.

it may be fifteen or sixteen, but there is always a notable difference. It must be borne in mind that the comparative results must be, in each case, those obtained at the same examination, for the frequency of the sounds of the fœtal heart varies from one time to another. Usually the maximum of intensity of the heart-sounds of one fœtus is found higher than that of the other, nor are the two maxima upon the same side of the median line. For example, referring to Fig. 105, one maximum might be heard at D, and the other at A or at C. The conclusion as to multiple pregnancy should not be drawn from a single examination, lest an error may arise from change of position of the fœtus, in case of single pregnancy, or from change in the frequency of its heart-sounds. Of course, an error might occur in case there were more than two fœtuses in the uterus, but the contingency of triplets even is so small that mistakes thence resulting will be very rare. In a case of triplets, H. F. Naegele, by auscultation during pregnancy, diagnosed twins; when labor occurred, and after one of the children had been born, he, by the same means, discovered that there were still two fœtuses in the uterus, and then made the diagnosis of triplets.

Even if the practitioner, after careful examination, is positive of a plural pregnancy, it is not wise in most cases to let the woman know his discovery, for to some the fact would be a source of fear and anxiety as to the labor, and to others, of care and worry as to the double burden which would be imposed upon them after the birth of the children. Of course, auscultation will be without value in the diagnosis of plural pregnancy if one of the fœtuses be dead, but palpation might then be of use. It is better, however, especially for the young practitioner, not to depend exclusively upon either mode of examination, but rather combine them, modifying the results obtained by one with those derived from the other.

Differential Diagnosis of Pregnancy. Certain pathological conditions may be mistaken for pregnancy, and the chief of these, with the means by which error as to their character may be avoided, will now be given.

First. *Affections which Increase the Size of the Uterus.*

Physometra. Gas may be formed in the uterus from decomposition of retained secretions or of fragments of an ovum. This gas may be retained if there be acquired atresia, or it may be discharged from time to time in case there be only stenosis. When stenosis and discharges of gas occurred Gooch called the condition flatus of the uterus. Of course, there is little danger of confounding a case of either form of the disorder with pregnancy. The uterus is but slowly and slightly increased in size; if it be large enough for percussion to be made, the tympanitic sound evoked points to the nature of the enlargement, and at the same time palpation and auscultation give negative results.

Hydrometra. A collection of watery fluid may take place in the uterus when the os is occluded. Usually the uterus is no larger than an orange, and the increase of size is slow; it generally occurs in women who have passed the childbearing period, though Voisin met with it in a patient only forty years of age. Schröder has mentioned a case of its occurrence in a woman in consequence of cervical atresia caused by

the application of the actual cautery for sarcoma. In hydrometra, too, the development of the uterine tumor is slower than in pregnancy, and the other usual signs of this condition are absent. Both physometra and hydrometra are rare.

Hæmatometra. Accumulation of menstrual blood in the uterus has given rise to some most deplorable errors of diagnosis, errors that, however, can be readily avoided by a careful study of the history of the enlargement, followed by a suitable examination. Such an accumulation results from either congenital or acquired atresia of some part of the genital canal, and of course this atresia can be readily ascertained by a direct examination. The history of the enlargement is that it has lasted longer than pregnancy does, that it has taken place abruptly from time to time, increasing periodically instead of continuously; the periods of abrupt increase, as a rule attended with more or less severe suffering, usually occurred once in each month. Upon palpation the uterus is found tense and resisting, not yielding and elastic as it ordinarily is in pregnancy; no fœtal parts can be felt, and auscultation is negative.

Uterine Fibroids. The uterus is in most cases irregular in form, and is hard and resisting, instead of elastic and yielding. Instead of menstruation being absent, as is the fact in pregnancy, it is usually irregular and profuse; the mammary signs of pregnancy are as a rule absent, and the umbilicus does not show the changes which occur in the pregnant woman. The sympathetic disturbances of the early months of gestation have not been observed, and the growth has been much slower than the physiological development of the uterus; the cervix does not present the changes characteristic of pregnancy. The uterine souffle may be present, but the sounds of the fœtal heart are absent.

Increase in Size of Abdomen without Change in Size of Uterus—Ovarian Tumors. Among the means that may be available in distinguishing these growths from pregnancy are the presence of menstruation, and the enlargement having been first observed upon one or the other side instead of in the median line, and its development being slower than that of pregnancy. But amenorrhœa is found in quite a number of patients suffering with cystic ovarian disease either if they have become anæmic, or internal hemorrhage has occurred; as to the place of origin of the enlargement, unfortunately many patients observe badly or forget readily, so that this help often fails, and while usually the enlargement of pregnancy is more rapid than that of an ovarian tumor, exceptions to the rule may occur.

The deterioration of health and the emaciation, especially noticeable in the face, will be marked if the tumor has attained great size. The fluctuation is usually distinct in cystic disease of the ovary, absent or very obscure in normal pregnancy; in polyhydramnios the fluctuation is quite marked, but it is especially at the upper part of the abdomen, while in ovarian dropsy the fluctuation is commonly more general. The results of touch and auscultation are negative, and the reflex disturbances of pregnancy are generally absent. Nevertheless, there are some cases in which a positive diagnosis should not be given at once; delay and repeated examinations may be necessary to avoid a mistake.

Ascites. It seems strange, nevertheless it is true, that the abdomen enlarged by ascitic effusion has been mistaken for the enlargement of pregnancy. The shape of the former is different from that of the latter, and fluctuation is always distinctly and everywhere present, whereas in pregnancy fluctuation is not distinct except in polyhydramnios, and then chiefly discovered in the upper part of the uterus. In ascites the uterus is unchanged in form, size, and position; the menstrual function may be regularly exercised, and the reflex disturbances of pregnancy are absent. The disease has in most cases an obvious cause in some affection of the liver, kidneys, or heart. Palpation and auscultation give negative results as to pregnancy.

Accumulation of Fat in the Abdominal Wall or in the Omentum. Such an increase of size is more frequently observed in women from forty to fifty years of age than at any other time of life. The abdominal wall becomes not only prominent but pendent, and the woman has, as Dr. Bailie expressed it, a double chin in the belly. In such a subject it is generally easy, if she be lying down, for the physician, placing a hand on each side of the abdomen, to include between them the entire mass, and partially lift it up, thus determining its true character. There is entire absence of the signs of pregnancy furnished by auscultation and touch.[1]

Pseudo-Cyesis, or False Pregnancy. False, or nervous, pregnancy generally occurs in women who have married late in life, and who are anxious for offspring, or who wish to give proof of their still having the power of reproduction. They frequently present many of the subjective and some of the objective signs of pregnancy, the intense desire to be pregnant begetting many of the evidences of the condition. In some of these subjects abdominal enlargement may be observed; menstruation may be absent, or scanty and irregular; the breasts may increase in size and contain milk; the stomach may be irritable; and, finally, the woman is usually positive that she feels fœtal movements. The climax of the delusion of spurious pregnancy may be spurious labor. The etiology of these cases is obscure. The women are honest in their belief, they do not desire to deceive others, but they are themselves deceived. Nor can this self-deception and the phenomena of false pregnancy and labor be accounted for by the action of the imagination, for similar phenomena have been observed in some of the inferior animals.

Over-fed bitches, which admit the dog without fecundation following, are nevertheless observed to be sluggish about the time they should have whelped, and to bark as they do when their time is at hand, also to steal away the whelps from another bitch, to tend and lick them, and also to fight fiercely for them. Others have milk or colostrum, as it is called, in their teats, and are moreover subject to the diseases of those who have actually whelped. (Harvey *On Conception.*)

Professor Haughton reported to the Dublin Obstetrical Society (February 7, 1880) an interesting case of phantom tumor observed in an ass that had been covered by a zebra; the appearance of pregnancy deceived an expert.

[1] If the obesity is rapid in its development, if there are abdominal striæ, and amenorrhœa is present, the liability to error is increased. Such a case recently came to my knowledge, and the diagnosis of pregnancy having been made, and false labor coming on, Cæsarean section was done —the patient had a deformed pelvis—and the increase in size was proved to be solely from deposit of fat in the abdominal wall.

In the diagnosis of pseudo-cyesis the physician must give little or no weight to the subjective signs of pregnancy, or he will almost certainly be misled. Let him, therefore, if the alleged pregnancy be far enough advanced to make the objective signs available, trust to them, and in the contrary condition wait until they ought to be plainly present in a case of true pregnancy. Usually these patients, as has been frequently observed, do not send for the physician until they have been, as they think, pregnant for several months, and then they do not ask for a diagnosis—that they have made for themselves—but for the relief of some temporary indisposition, or to attend them in their approaching labor. To undeceive such a one, proving that her hopes are false, is generally a thankless and difficult task; it ought not to be attempted without first having conclusive evidence obtained by touch and auscultation.

Pathological Conditions Rendering the Diagnosis Difficult. In case of pregnancy occurring in a woman suffering from an abdominal enlargement the former is liable to be overlooked, the pathological condition only being recognized. In some cases it is possible to remove the cause or condition hiding the pregnancy, and then the latter will be discovered. Thus, if ascites be present, after paracentesis the proofs of pregnancy may become evident. But the chief means to avoid error from these sources are repeated examinations and waiting until the signs of pregnancy become unequivocal. Pajot, in referring to such difficulties, remarks that there is one distinct characteristic of the gravid uterus by which it may be known from ascites, fibroids, hæmatometra, ovarian cysts, etc., that is, that it, in the last third of pregnancy, is the only abdominal tumor in which there is found a mobile solid body in a liquid.

The obstetrician should bear in mind that abnormal pregnancy, *e. g.*, ectopic gestation, cystic disease of the ovum, or polyhydramnios, will often present peculiar difficulty in diagnosis.

Diagnosis of Previous Pregnancy. In some cases it is important to know whether a woman is pregnant for the first time, or whether she has been pregnant before, the pregnancy not ending in abortion. In the primigravida the abdominal wall is smooth, tense, and resisting and cannot be readily depressed; the uterus is more strictly confined to the vicinity of the median line, and especially does not incline anteriorly so much as it does in the multigravida. In the later part of pregnancy the striæ usually found upon the skin of the abdomen are not white or pearl-colored, but pink or purplish. The mammary glands are round, full, prominent, firm, not relaxed, flabby, and pendent. The vulval orifice is small, closed, the posterior commissure complete, the hymen may be torn, but the carunculæ myrtiformes are absent. The vagina is comparatively small, and the rugæ are distinct, prominent, and in intimate contact by the close apposition of the anterior and posterior vaginal walls. The neck of the uterus is conical, its orifice, which is closed, presenting a uniform rim or border.

In the multigravida the abdominal wall is relaxed, not tense and resisting; possibly separation of the recti muscles is present, the striæ,

pearl-colored, of a former pregnancy may be present, and possibly, too, with them there may be seen the purplish striæ of the present gestation; a thinned abdominal wall permits more readily palpation of the uterus. The breasts are less firm, the glandular portion can be defined; they usually are somewhat pendent, and in many cases they are marked by old striæ. The vaginal entrance is partially open, the labia majora relaxed, pigment deposit is observed, and frequently there are varicose veins. The hymen has given place to the carunculæ myrtiformes, the presence of cicatricial tissue at the perineum is not uncommon. The vagina is wide, relaxed, its surface much smoother than is that of the primigravida, and either the anterior or posterior wall may project into the canal. The vaginal portion of the cervix is club-shaped or cylindrical, and the os uteri is usually split, so that an anterior and posterior lip are distinctly defined. In very rare cases this physiological tear of the os has not occurred, so that to the touch it presents the character observed in the virgin or of a woman for the first time in gestation. Again, tearing of the cervix may be caused by the extraction of a large fibrous tumor from the uterus. The possibility of error from either of these causes should be borne in mind. Admitting that the woman has been previously pregnant, the pregnancy may have ended in a miscarriage, and then, of course, the diagnosis from physical examination may fail. So too, if a completed pregnancy occurred some years before, there may sometimes be difficulty in the diagnosis.

Diagnosis of the Time of the Pregnancy. In some cases it is of importance to determine how far the pregnancy has advanced. Independently of an estimate made of this time, by counting from the supposed date of conception, an approximately correct conclusion may be obtained by an objective examination. This examination gives more satisfactory results in primigravidæ than in multigravidæ, because in the former the changes caused by pregnancy are more characteristic and typical.[1] The chief means in making this diagnosis are the changes in the neck of the womb, including, in multigravidæ, the patency of the external os, and the progressive permeability of the cervical canal; the size of the uterus as learned by bimanual examination, and the distance of the fundus above the pubes as measured on the abdominal wall; the changes in the umbilicus, and the formation of the secondary mammary areola; the time when the uterine souffle and the fœtal heart-sounds become audible, and the measurement of the length of the fœtus. With the exception of the last, measuring the fœtal length, all these have been considered. Ahlfeld's method of ascertaining the length of the fœtus is to put one knob of the calipers in the vagina, so that the head of the fœtus is touched necessarily through the thickness of the uterine wall, while the other is placed at the fundus of the uterus, as near as possible to the highest part of the breech, the abdominal and uterine wall, of course, intervening. The length of the child is about twice this measurement. Knowing what its length usually is at successive months, a conclusion may be drawn from the length of the fœtus, ascertained by this measurement, as to the time of the pregnancy.

[1] Schröder.

DURATION OF PREGNANCY.[1] Since pregnancy does not begin immediately after coition or insemination, but with the actual union of the spermatozoid and ovule, and as an uncertain time intervenes between insemination and conception, it is impossible for us to know its actual duration. We know in all cases when it ends, but in no case when it begins. In those rare instances in which pregnancy was known to have resulted from a single coition, the date of the coition does not correspond with the beginning of gestation. It is probable that in any case some hours, and in many several days intervened before the combination of the male and the female element occurred; Schröder states that the interval may be from one to fifteen days. Further, we do not know whether the ovule that is fecundated[2] is the one liberated at the menstrual period immediately preceding the sexual intercourse, or the one corresponding to the succeeding menstrual suppression, or one escaping from its ovisac in the menstrual interval. Hence a variation of a few or of several days in the time when pregnancy actually begins.

While denied this certainty of knowledge, general observation agrees in making the period of gestation nine calendar or ten lunar months. Harvey said: "Unquestionably the ordinary term of utero-gestation is that kept in the womb of his mother by our Saviour Christ, of men the most perfect; counting, viz., from the festival of the Annunciation in the month of March to the day of the blessed Nativity, which we celebrate in December. Prudent matrons, calculating after this rule, as long as they note the day of the month in which the catamenia usually appears, are rarely out of their reckoning, but after ten lunar months have elapsed fall in labor and reap the fruit of their womb the very day on which the catamenia would have appeared had not impregnation taken place."[3] Dr. Matthews Duncan speaks of Harvey's opinion here quoted, as "very correct," and also states that his remarks tally with the late Dr. Tyler Smith's ingenious views upon the question.

When pregnancy resulted from a single coition the average interval between it and labor was two hundred and seventy-five days. The average interval between the end of menstruation and labor is two hundred and seventy-eight days. Variations from these averages will be considered subsequently.

PREDICTING THE DATE OF CONFINEMENT. Tables for readily calculating the time of labor are usually found in "Physicians' Visiting

[1] Montaigne has the following remarks upon the duration of pregnancy: "Here, again, are the physicians, the philosophers, the lawyers, and the divines, by the ears with our wives, about the dispute, 'for what time women carry their fruit,' and I for my part, by the example of myself, side with those who maintain that a woman goes eleven months with child. The world is built upon this experience; there is not so simple a little woman that cannot give her judgment in all these controversies, and yet we cannot agree." But Montaigne wrote in the sixteenth century.

Referring to the opinions as to the duration of pregnancy, there is found in Herodotus the story of a Spartan king, Demaratus, born seven months after his mother's marriage, and in answer to the charge of his illegitimacy she made this statement: "Women bring forth at nine months and seven, and all do not complete ten months."

[2] "His found by careful examination of 16 embryos that in 12 the stage of their development showed them to be the result of impregnation at the time of the first missing menstrual period, while the 4 others corresponded to the last preceding menses, and it only remains to prove by a more extended series of observations which is of more frequent occurrence."—Winckel.

[3] Professor A. R. Simpson, referring to Harvey's statement fixing the duration of pregnancy as 275 days, remarks: "The dates are derived only from the teachers of the Roman Catholic Church, and when their true meaning is investigated it is found that the 25th of March was held as Lady-day in Pagan Rome, in honor of Cybele, the mother of the Babylonian Messiah, long before the era of our Lord; while the 25th of December was kept among many Gentile people as the birthday of the Son of that "Queen of Heaven.'"

Lists," and therefore it is unnecessary to insert any here. But, moreover, there are simple rules by which the calculation can be made, and therefore such tables and "periodoscopes" may well be omitted. One plan is to count the number of days between the beginning of the last menstruation and that of the one immediately preceding it, and multiply the number by ten; labor comes on at what would have been the tenth menstrual period had not pregnancy occurred. A much simpler rule, given by Tarnier, is this: Count nine calendar months from the cessation of the flow, and add five days. Or we may add five days to the date when the flow stopped and count back three months. Thus, a woman ceased to menstruate on the fifteenth of February, now adding five to fifteen we have the twentieth of the month, and then counting back from the twentieth of February three months, we find that the twentieth of November is the probable day of labor.

An objection to the plan of counting the duration of the pregnancy from the duration of the menstrual cycle arises from the fact that in many women this is not a uniform period, often varying from one month to another, and it certainly is very different in different individuals. According to such plan, the woman who menstruates every three weeks ought to have her pregnancy end in two hundred and ten days, while another whose period may happen to be thirty-one days would have her pregnancy protracted to three hundred and ten days.

"Quickening" has been by some regarded as so uniformly occurring at four months and a half that the time of the ending of pregnancy might be determined from the date when this was observed. But, as previously stated, this phenomenon is not so regular in its time of manifestation as to give accurate guidance. In some cases it may serve to correct an error that has been made in regard to the date of the last menstruation, and may assist in forming a probable conclusion as to the time when labor will occur.

While it is usual to speak of predicting the day of confinement, it should be remembered that the prediction is only a probable one, and indeed that the day when labor occurs is most frequently either just before or just after this.

Precocious Births. La Motte has given the history of a woman who was delivered of a child seven months after marriage; her husband suspected her chastity, but seven months after her convalescence she was delivered again, greatly to the relief of the husband's mind; her daughters married, and each of them was delivered at seven months. He also mentions another case in which marriage took place the day that the bride left the convent, and just seven months subsequently labor occurred; after recovery she again became pregnant, and this pregnancy also lasted only seven months. Both children lived.

One of these cases was quoted by Depaul, and he observed that while precocious births are generally admitted, the unanswerable facts proving them are very rare. The late Dr. Hodge taught that in many instances strong and healthy children are delivered before the usual time. The same belief was expressed by Spiegelberg. Yet it seems improbable that a child born, for example, at seven months will present the devel-

opment of one born at nine months.[1] Ronaldson[2] has reported a case of "early viability," the child being born six calendar months and nine days after coition.

The French law recognizes as legitimate a child born six months (180 days) after marriage; but while this is a legal viability, yet it is quite exceptional for a child born before the completion of seven months to live, and even if born then, very great care is generally necessary to preserve its life. The nearer the time of birth approaches the normal the greater the probability of the child living. While not claiming that a child born at eight months will be as vigorous and as well developed as one born at full term, it is not unreasonable to believe that in some cases the fœtus may develop somewhat more rapidly, its growth favored especially by abundant supply of nutriment, than in other cases, just as seeds may germinate more rapidly, or plants have their fruits and flowers earlier in one soil than in another; in other words, there may be precocious births, but the boundary within which this may occur, though incapable of being defined, is probably a very narrow one.

A case recently under my care has convinced me that occasionally precocious births do occur: Mrs. ——, six years married, pregnant three times, each pregnancy ending in miscarriage, one in the fifth month, the others at earlier dates. The patient first came under my care three years ago, on account of retroversion of the uterus. In October, 1893, I attended her in a miscarriage. In the spring of 1894 menstruation became somewhat irregular, and there were occasional discharges of blood in the intervals. I thought these probably resulted from an early and incomplete abortion, not included in the list of three, and determined to curette the uterus. This curetting was done on the 18th of June, and followed by an injection of Churchill's tincture. She left the hospital the last day of the month, and menstruation did not reappear. Pregnancy was soon believed to exist, the belief becoming a certainty in October. In consequence of a severe fright, fire breaking out in her house, premature labor, no premonitory symptoms whatever, especially no change in form, occurred on the 7th of February, and after twenty-four hours she was spontaneously delivered of a living female child, which weighed nearly seven pounds. The child, though not so strong nor so active as one born at term, certainly greatly exceeded in vigor that usually observed in a seven months' child: the fontanelles were much larger than in a child born at term, and the cranial bones less firm. The infant was kept in Auvard's incubator for three weeks. The pregnancy could not have exceeded 226 days, or eight lunar months and two days, and the assurance was given me that it was even less than this period. It is impossible to admit that even if pregnancy was present at the time of the curetting it could continue after it. I am, therefore, led to believe with La Motte, and some other of the older obstetricians, in a more rapid development of the fœtus in exceptional cases than that usually observed.

Prolonged Pregnancy. Few questions in obstetrics have caused more controversy than as to whether the period of utero-gestation can be materially prolonged beyond 280 days. It is still unsettled. As late as 1870, in a trial before the Court of Queen's Bench, upon the charge of seduction, very contradictory evidence as to the prolongation of the ordinary period of pregnancy was given by distinguished obstetricians. In the United States obstetric authorities have generally up-

[1] It is somewhat remarkable that we have comprised within a few lines in the nineteenth book of the Iliad, 115–119, not only a statement of the normal period of human pregnancy, nine months, but also an example of the successful induction of labor at less than seven calendar months, and of the prolongation of pregnancy beyond nine months in another subject.

[2] Edinburgh Obstetrical Society's Transactions, vol. vi.

held the view that gestation may be prolonged. Dewees asserted that in each of four women under his observation pregnancy lasted ten calendar months. Bedford stated that there is undoubted evidence that pregnancy occasionally extends beyond 300 days. Dr. Hodge gave from his own practice a case in which he regarded it as certain that pregnancy continued 302 days. Warrington, apparently founding his opinion upon the evidence in the Gardner Peerage case, says that some women have been pregnant ten calendar months (311 days). Meigs, after detailing Asdrubali's case, in which pregnancy was alleged to have continued thirteen months and twenty-two days, and expressing his belief in its truth, narrated the history of a pregnant woman under his own care, whose pregnancy lasted 420 days. American physicians have reported in medical journals a few instances of protracted gestation. Among these is that of a case in which pregnancy was believed to have continued 330 days.[1] Dr. L. A. Rodenstein has given four cases of prolonged pregnancy;[2] he suggests as the probable limit to this increased duration, two months.

Rossie has published[3] a case in which pregnancy did not end until 317 days after coition. McTavish[4] gives a case in which he believes pregnancy lasted 318 days, and Maur,[5] one of 334 days.

It has been in this country judicially decided that pregnancy may last 317 days.

Thomson has recently reported a case in which pregnancy lasted 317 days from the last menstruation, or 301 from the last coition.[6]

Some of the most eminent of foreign physicians have held that prolonged gestation may occur. Naegele, in his well-known work, asserts that there are undoubtedly cases in which the pregnancy has lasted 300 days and even longer. The late Dr. Churchill[7] said: "Dr. Montgomery relates two cases in his work, one of which came under my observation; in the first, the gestation continued 291 days, and in the second, forty-one weeks and two or three days at least." He adds to this statement, that the question being one chiefly of authority, positive evidence must infinitely outweigh mere negation. Spiegelberg[8] has remarked that the variations in pregnancy lie chiefly between the 265th and the 280th days; cases in which a fœtus has matured in a shorter time are rare, somewhat more frequent are those in which birth took place after 280 days. Individual conditions certainly have an influence upon the pregnancy, thus primiparous and legitimate pregnancies end earlier than their opposites. He also refers to the dependence of the duration of the pregnancy upon the menstrual cycle, as pointed out by Cederschojold and Berthold, and hence variations in individuals according to their menstrual periods; there may be also variations in the same person in different pregnancies. Winckel, from his own study of cases in which pregnancy followed a single cohabitation, and from the observations of others, reaches the following conclusion: The average duration of pregnancy is about 280 days; it may vary, however, from 240

[1] Boston Medical and Surgical Journal, May, 1859.
[2] American Journal of Obstetrics, June, 1882.
[3] Ibid., January, 1886.
[4] New York Medical Journal, April, 1889.
[5] Ibid., May, 1889.
[6] London Obstetrical Society's Transactions, vol. xxvii.
[7] Theory and Practice of Midwifery.
[8] Op. cit.

to 320 days, and perhaps even exceed this latter limit, and such excess is by no means so rare as was formerly supposed, for in 6.8 per cent. the duration is over 300 days. Ahlfeld states that pregnancy in women varies from 220 to 330 days, counting from coition. He also quotes the case reported by Sarwey in, which labor occurred 341 days after the last menstruation, as doubtful because the date of impregnation was not known. So, too, Olshausen[1] has said that the duration should not be restricted to 300 days, but the limit ought to be advanced to 320 or 325 days. Hohl is quoted by Olshausen, op. cit., to the effect that prolongation to 308 days is not rare, and that even 321 and 336 (case of von Rieche) may occur.

On the other hand, Stoltz takes the position that pregnancy cannot be prolonged more than fifteen days; Depaul, referring to the French law making a child legitimate born 300 days after the departure or death of the husband, considered the limit very large; Kleinwächter denies prolonged pregnancy; Dr. Robert Barnes holds that a pregnancy lasting 300 days is highly improbable; and Tarnier states that it is impossible to admit an intra-uterine pregnancy passing the highest limit of normal pregnancy unless some obstruction at the cervix prevents delivery.

That labor may be delayed for a few weeks is the belief of many obstetricians from their personal observations. Thus, in illustration, it is not uncommon for a woman, in most cases a primigravida, who passes the time at which her delivery, counting from her last menstruation, was expected, and then after a delay of two, three, or even four weeks, falls in labor; the labor is tedious, a large head, its ossification further advanced than is usually found at birth, is to be moulded; in some cases the forceps must be used, but whether the child be delivered spontaneously or artificially, it weighs considerably more than the average, and not unseldom is stillborn. Delore mentions an instance of a primigravida whose gestation lasted a month beyond the usual period; Duncan, one of a multigravida in whom the pregnancy also lasted a month over time, the child weighed ten pounds and four ounces, and the placenta two pounds. Schröder quotes the case reported by Rigler, as "a very conclusive one" in proof of prolonged pregnancy. A woman four weeks after the expected term, give birth to a dead male infant, weighing ten pounds and a quarter, the hair and the nails were well developed, and the placenta weighed more than three pounds.

Cases of this kind will be admitted by most as proving the prolongation of pregnancy. Such facts, belonging so generally to personal experience, have more weight than an appeal to the uniformity of Nature's laws. The argument drawn from occasional instances of prolonged pregnancy in some of the inferior animals, also has weight in sustaining the view that this is not impossible in the human female. For example, the average duration of pregnancy in the cow is 282 days, but the time may be prolonged to 321 days.

Reese,[2] in his excellent manual, takes the ground that it is possible for human pregnancy to be prolonged beyond the usually admitted nor-

[1] Centralblatt f. Gynäkol., 1889.
[2] Text-book of Medical Jurisprudence and Toxicology.

mal period, but that the question how far beyond is more difficult to answer, though the greater the amount of the deviation, the stronger and more convincing should be the proofs. He further indorses the statement of Taylor to the effect that we must "be prepared to admit either that conception may in some cases be delayed for so long a period as five to seven weeks after intercourse, or that there may be a difference of from five to seven weeks in the duration of pregnancy."

In regard to the question of a perfectly matured child being born prior to the normal period of pregnancy, he criticises the evidence given by the late Sir James Simpson in an English case, in which the legitimacy of a child was made to depend upon the period of the mother's gestation, 259 days, Sir James testifying that it was impossible for a child perfectly matured to be born three weeks before the usual term.

I am indebted to James P. Baker, Esq., of Indianapolis, for the following presentation from a legal standpoint of the duration of pregnancy:

The period of gestation is frequently a matter of judicial inquiry, particularly in bastardy proceedings and in controversies among heirs affecting legitimacy. Lord Coke, who was one of the great masters of the common law, in his work upon Littleton, written nearly three hundred years ago, held that nine months, or forty weeks, is the longest time allowed. Mr. Hargrave, in his edition of *Coke upon Littleton*, at page 123 b, carefully reviewed the law, and came to a different conclusion. In summing up, he said:

"The precedents, therefore, so far from corroborating Lord Coke's limitation of the *ultimum tempus pariendi*, do, upon the whole, rather tend to show that it hath been the practice in our courts to consider forty weeks merely as the more *usual* time, and consequently not to decline exercising a discretion of allowing a longer space where the opinion of physicians or the circumstances of the case have so required. In the course of our inquiries into the subject of this note we were curious to know the general sentiment of that eminent anatomist, Dr. Hunter, on three interesting questions. These were, What is the *usual* period of a woman's going with child? What is the *earliest* time for a child's being born alive? and What is the *latest?*"

Dr. Hunter's answer was as follows:

"1. The *usual* period is nine calendar months; but there is very commonly a difference of one, two, or three weeks. 2. A child may be born alive at any time from three months; but we see none born with powers of coming to manhood, or of being reared, before seven calendar months, or near that time. At six months it cannot be. I have known a woman bear a living child, in a perfectly natural way, fourteen days later than nine calendar months, and I believe two women to have borne children alive in a natural way, above ten calendar months from the hour of conception."

Mr. Hargrave's note has been frequently quoted by the courts up to the present time, and is still regarded as a sound exposition of the law. The question may arise, Which Dr. Hunter gave the above reply? Hargrave lived in London, and wrote the preface to his edition of Coke in January, 1785. Dr. William Hunter died in 1783. Dr. John Hunter, his brother, died in 1793. The note was probable written near the time of the completion of Mr. Hargrave's work. It is probable, therefore, from these facts, though not certain, that John Hunter was the author of the reply. But a certainty seems to be established by Mr. Hargrave referring to Dr. Hunter as "that eminent anatomist," a designation which applied more especially to John than to William Hunter, for the latter was more celebrated as an obstetrician.

Judges, like doctors, are liable to differ, and the decisions of courts have not been entirely harmonious as to the period of gestation. In the case of O'Brian *v.* The State *ex rel.* Swift, 14th Ind. 469, the Supreme Court of Indiana say:

"Those who have investigated the subject know that in the course of nature a child living and capable of surviving to the ordinary age of man may be born in seven, and may not be born until the expiration of ten months from the cessation of the *catamenia* indicating the time of its conception."

The case of Duck *v.* The State *ex rel.* Dill, 17th Ind. 210, was a prosecution for bastardy. In such a case the question always is, "Is the defendant the father of the child?" Any evidence tending to show that any other man is the father is admissible. The child was born on September 18, 1858. On the trial the defendant offered to prove that the relatrix had had sexual intercourse with another person in the first week of November, 1857. The evidence was rejected. The Supreme Court held that this evidence was rightly rejected, and said:

"It is true, experience proves that the period of gestation is almost as variable in individual cases, though within narrow limits, as that of the length of human life, but the longest period we have ever known to be judicially allowed was 313 days. See the case of Commonwealth *v.* Hoover, 3d Clark, Pa. 514. In the case at bar the evidence might have covered a period of 322 days."

A still longer time was judicially allowed, however, in the case of the United States *v.* Collins, tried in the U. S. District Court for the District of Columbia in 1809, and reported in Cranch's *Circuit Court Reports*, vol. 1, page 592. The case was an indictment for not supporting a bastard child. The mother was received as a witness. The attorney for the government objected to the cross-examination as to her connection with other men than the defendant. The Court overruled the objection, but limited the time of inquiry to a period of not more than twelve months nor less than six months before the birth of the child. This is an extreme case. In Paul *v.* Padleford, 16 Gray (Mass.), 263, a bastardy prosecution, the Court refused to allow proof of acts of intercourse of the plaintiff with other persons than the defendant, at a time more than ten months and twelve days before the birth of the child. In Phillips *v.* Allen, 2d Allen (Mass.), 453, the Court said:

"The child was born in eight months after the marriage, and the fact that a child is born thus soon after the husband had first access to the wife does not prove beyond all reasonable doubt that the child is not his. There are ancient decisions that gestation somewhat more than nine months after the husband could have had access to the wife, does not disprove the legitimacy of the child. See Hargrave's note to *Coke's Litt.* 123 b, where these decisions are cited, and where in support of them the testimony of Dr. Hunter is introduced, expressing his opinion that gestation often varies from one to three weeks from nine calendar months, and that children are sometimes born in seven months from conception, and live and grow to manhood."

In Eddy *v.* Gray, 4 Allen (Mass.), 435, which was a bastardy prosecution, the Court below had admitted testimony tending to show illicit intercourse by the complainant with other men than the defendant at a period of time more than ten months before the birth of the child. The Court said:

"Such testimony, in the absence of proof that the period of gestation extended beyond the usual duration according to the common and natural course of life, which is recognized as well by legal as medical authorities, is inadmissible, and should have been excluded. See *Coke's Litt.* 123 b, and note by Hargrave."

In the recent case of Ronan *v.* Dugan, 126 Mass. p. 176, a prosecution in bastardy, the Supreme Court of Massachusetts say:

"In cases of this kind, the admissibility of evidence of illicit intercourse of the complainant with any other man than the defendant depends upon the relation to the time when the child was born. In Eddy *v.* Gray, 4 Allen, p. 435, where the intercourse offered to be proved occurred more than ten months before the birth, the evidence was held to be inadmissible without proof that the period of gestation was prolonged beyond the usual duration. We see no reason why the same rule should not be followed where the intercourse offered to be proved took place less than seven and a half months before the birth, in the absence of the proof that the birth was premature."

In such a case the Tennessee Code limits the inquiry between the first of the tenth and the first of the sixth month next before the birth of the child. See Crawford *v.* The State, 7, Baxter, 41.

Wharton, in his work on *Evidence*, at section 344, says:

"The court will take judicial notice of the ordinary periods of gestation, so as to assume the non-legitimacy of children born ten months after intercourse, or when prior non-intercourse is proved five months after the act of intercourse."

At section 1300 he says:

"The time of conception is determined by the Roman practice by reckoning backward from the time of birth; and the rule is that there must be not less than one hundred and eighty-two days and not more than ten months to establish legitimacy. German jurists have continued to maintain the minimum of one hundred and eighty-two days. In our own practice the question of legitimacy, when a child is born on either side of the usual limits of parturition, is determined on the testimony of experts; though in cases beyond question, the court may determine what is notorious as a part of the ordinary laws of nature."

After all, the light of the courts in this matter is reflected light. Physicians must determine the matter; and if the space between the minimum and maximum periods, hitherto allowed, is shown to be too long or too short, the courts will readily follow the truth as it is made manifest.

Missed Labor. This term, introduced by Dr. Oldham, is applied to those cases in which a fœtus dying after the period of viability has been reached is retained in the uterus for weeks, or even months, beyond the time when pregnancy ordinarily ends. In these cases nature makes an effort at the normal time to expel the contents of its cavity, but the effort fails, and the pregnancy continues an indefinite period until those efforts are renewed successfully, or the contents are removed by artificial means.

In some cases the failure to expel the contents of the uterus has been from resistance of the os, *e. g.*, the obstacle may be cancer of the cervix. Other explanations given by Spiegelberg are an abnormally firm connection of the ovum with the uterus, or anomalous degrees of irritability.

In missed labor the amnial liquor may be absorbed and the fœtus become mummified; in other instances a lithopædion results. In rarer cases suppuration of the fœtus may occur, the purulent discharge usually finding its way externally through the vagina.

It has been shown that some of the cases of supposed missed labor were really instances of ectopic gestation, or of gestation in a rudimentary uterine horn.

CHAPTER IX.

THE MANAGEMENT OF PREGNANCY.

Woman only escapes being sick twelve times a year by having an illness which lasts nine months, was the assertion of a once famous French *litterateur*. Though, of course, rejecting this statement and denying that gestation is a disease, we must admit that it has many discomforts, and in numerous instances causes great liability to pathological conditions, and in some these conditions are manifested. The remarkable changes that occur in the organism or in the organs of a pregnant woman may open the way for maladies which are manifested during or subsequent to the pregnancy. It is advisable, therefore, that all care, and even precautions, be taken to ward off threatened dangers and to conduct the subject safely through her pregnancy, both in her own interest and in that of her offspring.[1]

The conduct of pregnancy includes hygienic and medical care.

Hygiene of Pregnancy. This relates to food, clothing, air, exercise, rest, sleep, bathing, care of the breasts, and to the mental condition.

Food. In many cases during the first months of pregnancy the disturbance of the stomach, and the less active life often consequent upon this disturbance, and in some the associated mental anxiety, lessen the desire for food. Nevertheless it is better that an effort at least be made to have regular meals, although the quantity of food taken may not be as much as usual.

In some cases the morning sickness may be lessened, if not averted,

[1] That special care of the pregnant woman was in early times regarded as important is shown by the practices of many ancient people, and by the injunctions of old medical writers. The following, for example, are the directions given by Susru-fa, the earliest known medical writer of India, who lived at least fourteen hundred years before the Christian era. Many of these directions are wise, while the reason for others cannot be understood:

"The pregnant woman should avoid becoming weary, indulging in coition, sleeping in the daytime, watching at night, sorrow, climbing into a wagon, sitting upright, violent movements, phlebotomy, and long-continued exertion. Her longings must be satisfied in order that she may have a strong and long-lived child. From the first day she must be cheerful, pious, and clean in clothing and person. She should not touch dirty or deformed objects, nor eat any dry or spoiled food. She must not go out, or remain in an empty house, or go to the holy altar, or in graveyards, or near trees; she must avoid getting angry, carrying loads, or talking too loud."

Probably the first recorded example of the hygiene of pregnancy was given by Samson's mother when pregnant with the Jewish Hercules; she was to abstain from wine. There is reason for believing that drunkenness among the Jewish women was not uncommon at that time, or not long subsequently, as the interview between the priest Eli and Hannah, recorded in the first chapter of Samuel, suggests. Furthermore, abstinence from intoxicating beverages in pregnancy is certainly a rule of prudence, while great indulgence in them, according to excellent professional authority, is very mischievous. For example, Dr. Kirk, Glasgow Medical Journal, 1885, remarks: "For my part I am convinced that indulgence in alcohol beyond the most moderate extent is frequently in the last degree disastrous to a pregnant woman and her progeny."

Dr. Norman Kerr, in the second edition of his work upon Inebriety, London, 1889, says in reference to the influence of alcoholism of the parents upon the child: "The mother probably is the more important factor of transmission. She exerts an influence, not only with the father in the conception, but, in addition, during the whole period, of utero-gestation wields a special influence upon the unborn child." And again: "Considerable numbers of the children of female inebriates succumb to intra-uterine death. Of those who reach the period of birth, a goodly number have been so affected in the womb by the alcoholic cerebral and meningeal congestions, and other pathological states induced by alcohol, that they die from hydrocephalus or convulsions."

by the patient having a light breakfast an hour or two before rising.[1] When this disorder disappears the appetite usually returns, and in some is greater than it was before pregnancy. The food should be both animal and vegetable, and especially include digestible fruits in their season; for the latter will aid in preventing the constipation which so generally attends the pregnant condition.

It occasionally happens that a women when pregnant desires articles of food to which at other times she is indifferent; and these desires ought not to be refused, for they may express some need in her system for certain materials which are thus supplied; they are very different from the perversions of appetite that by some are imagined or assumed.

It is important that the stomach be not overloaded at any time, and especially in the evening. When the uterus encroaches most upon the stomach in the latter part of pregnancy it is generally the case that only a small quantity of food can be taken at a time, and then the meals may be more frequent than usual.

Alcoholic liquors ought not to be used, but the drink should be milk, water, or chocolate; those who are accustomed to coffee and tea will doubtless continue them, but these beverages should not be strong, nor taken in large quantities.

Clothing. This should be such as will not hinder the development of the abdomen and the breasts, and at the same time will protect from cold. The word *enceinte*, meaning in Latin ungirdled or without girdle, commemorates the custom of Roman women, who, when they became pregnant, laid aside their girdle, the *fascia mamillaris*, and it suggests avoiding all compression of the body. Baudelocque mentions the case of a girl who sought to conceal her pregnancy by tight lacing, and thus caused a dangerous hemorrhage. The corsets should be quite loose; the garters, if tight, may cause œdema of the legs, or varicose veins. Insufficient or unseasonable clothing may lead to an acute affection of the respiratory organs, attended with violent coughing, and the latter cause abortion; or sudden suppression of the perspiration occur from exposure to cold and result in albuminous nephritis. The high-heeled shoes so commonly worn by ladies tend to increase the forward inclination of the body, and thus render more difficult the position which a pregnant woman must take to preserve the centre of gravity when standing or walking; they make her more liable to missteps, and thus danger of falling, thereby injuring herself or the fœtus, and of jars that may case partial detachment of the ovum. If, as is often the case in the multigravidæ, the abdominal wall be greatly relaxed, permitting decided anteversion of the uterus, a suitable bandage contributes very much to the patient's comfort, and by correcting the malposition of the womb assists in preventing an unfavorable presentation of the fœtus.

Air. Pure air is of especial importance to the pregnant woman, for

[1] The late Professor Meigs stated: "Many of those examples that consist of nausea and vomiting during the early part of the day, but which cease after the meridian hour, may be set aside by the following method: Let a cup of coffee, with a toast, be brought to the bedside at the earliest morning hour. The patient should be called from her sleep to take this preliminary breakfast without rising from bed. As soon as it is taken let her lie down to sleep again, if possible. It appears useless to offer a rationale of this method. I am very confident, however, that, in a considerable number of persons it will be found to put a sudden stop to the vomiting as well as to the nausea. Certainly many of my patients have been speedily, as well as permanently, cured by it, and that in very distressing instances of the nausea."

she breathes for two, and is eliminating an increased quantity of toxic matter. A confined atmosphere has an injurious influence both upon her and upon the fœtus, and breathing air poisoned by carbonic acid may cause abortion. She should avoid all crowded halls, whether theatres, concert or ball-rooms, or churches; all poisons in the air, such as that of sewer gas or of infectious diseases, should be carefully guarded against; the room occupied in the day or in the night must be well ventilated; if possible, a part of each day ought to be spent in the open air.

Exercise, Rest, Sleep. If a woman in the first months of pregnancy suffers much from nausea and vomiting, she is little disposed to exercise; she is weak from the less amount of food taken or retained, and any movement may increase the gastric irritability. Again, toward the close of pregnancy her great size interferes with facility of movement; both her condition and instinct ask for repose more than for active exertion;[1] if we observe the conduct of pregnant animals, we find that as parturition draws near they are indisposed to exertion and spend much of their time lying down. But in woman during the intervening time daily exercise in the open air, carried to the point of slight fatigue, is one of the best means to increase her vitality and that of her offspring; her appetite is thus improved, her digestion better, and refreshing sleep secured. The best exercise is walking, and without some special reason against it, that should be chosen rather than riding. All violent motions, whether active or passive, such as riding over rough roads, equitation, dancing, ascending several flights of stairs, or lifting heavy weights must be forbidden; so, too, prolonged exercise, causing great fatigue, and protracted journeys by land or sea, are to be avoided. Regular hours of rest are to be observed; from eight to ten of the twenty-four may be given to sleep. In women liable to abortion absolute rest is often necessary, especially at the time corresponding with a monthly period, to guard them against the danger; in some rare cases, rest in bed during almost the entire pregnancy has been necessary in order to avert this accident.

Conjugal Relations. Obstetric writers agree in forbidding coition when there is a liability to miscarriage, in advising it to be less frequent in other cases, and abstained from at times corresponding with monthly periods, especially the third and seventh, in one the danger of abortion, in the other that of premature labor being greatest. Kleinwächter remarks that coition is to be restricted the first half of pregnancy, and unconditionally forbidden the second half. Dr. Benjamin Ward Richardson directs that the bed of the pregnant woman should be occupied by herself exclusively. Dr. Richard[2] says that if the human race were guided by the example of animals, and if it perfectly conformed to the advice of nature, which most frequently inspires the pregnant woman with complete indifference and even some aversion to marital caresses, coition during gestation would be entirely abandoned.

Other writers have referred to the aversion which Richard mentions. Thus Roederer[3] enumerated among the signs of pregnancy *viri fastidium*. It is re-

[1] Stoltz. [2] Histoire de la Génération. [3] Op. cit.

markable that among the signs of pregnancy given by Susru-fa the dread of coition is mentioned. Stolz[1] states that women have told him that as soon as they were *enceintes* they had *horreur du mari*, some of them by this sign first knowing that they were pregnant.

If the relation between husband and wife had no higher purpose than perpetuating the race, it is plain that sexual intercourse should cease when the vow of nature is being fulfilled; such indulgence may cause abortion, and has been compared to ploughing the soil when the seed is germinating; in many cases it is painful, excites or aggravates leucorrhœa, and may cause more or less reflex disorder. There is a moral side to this question. Many a wife must have less love and reverence for her husband when she, sick and suffering, or at least often wearied by the growing burden she bears, her mind a prey to anxious fears as to the issue of her pregnancy, is the victim of lust,[2] a lust which has no excuse in her desires, no demand for the continuance of the race. Man does not learn that self-restraint which makes him purer and nobler, but nourishes a passion that becomes more dangerous by such exercise than it could by any voluntary continence during his wife's pregnancy. Admitting that the state of society changes the instincts of nature, and that the indulgence condemned, in many cases, brings no immediate and obvious injurious physical results, it may well be questioned whether most obstetric writers have not, either tacitly or explicitly, granted a license which leads to evil rather than good.

Both Stoltz and Spiegelberg disapprove of sexual intercourse in pregnancy, but the former states that such disapproval is preaching in the wilderness, and the latter that it is preaching to the rocks. Nevertheless let the truth be spoken, whether men will hear or not, and let the right way be pointed out, though a multitude may choose to go in the wrong path.

Mantegazza, *L'Amour dans l'Humanité*, says: "The origin of polygamy may be purely hygienic. In many countries of Africa husbands cannot have any sexual relation with their wives during the period of pregnancy, nor sometimes during the period of lactation."

Bathing. The frequency and temperature of baths will depend upon a patient's previous habits; but usually once or twice a week is as often as a bath, cold or warm, is advisable:[3] hot baths, whether of the feet or of the entire person, must be forbidden. The external genital organs should be bathed daily with cool water as a protection from erythema, and to cleanse from increased secretion which retained might cause irritation; if leucorrhœa be troublesome, there is no objection to tepid vaginal injections of water, plain or medicated, *e. g.*, with common salt, creolin, chlorate of potassium, or borax; the fluid should be injected gently, used as a wash, not a douche.

The late Dr. G. W. Lawrence, for many years a distinguished practitioner at Hot Springs, Arkansas, informed me that abortions have frequently been caused by the use of hot baths at this famous health

[1] Op. cit.

[2] In Swift's terrible satire upon human beings, given in Gulliver's Voyage to the Houyhnhnms, it is stated that "the she-yahoo admits the male while she is pregnant," and this is spoken of "as such a degree of infamous brutality as no other sensitive creature arrives at."

For the following statements I am indebted to Ploss's work, Das Weib:

In the majority of heathen nations sexual continence is observed during pregnancy. Among many the abstinence from coition has arisen from the belief that the pregnant woman is unclean. By the Medes and Persians cohabitation with a pregnant woman was severely punished. Among some people polygamy is based upon abstinence from coition in pregnancy.

The old Hebrews and the Rabbis in the Talmud taught that coition during the first three months of pregnancy was very injurious to both the mother and child. Whoever cohabited on the ninetieth day did that which destroys human life, but the prudent Rabbi Abaja adds, "Since we cannot know this day with certainty, God preserves the simple from injury."

The ancient Irans very severely punished cohabitation with the pregnant woman. The man received 2000 lashes, and was compelled to carry 1000 loads of heavy and 1000 of light wood to the fire. He must offer in sacrifice 1000 of the smaller domestic animals, and kill 1000 snakes, 1000 land lizards, 2000 water lizards, and 3000 ants, and lay 30 bridges over flowing water.

[3] Warm hip-baths during the last week of pregnancy are by some thought useful in facilitating labor.

Constipation. If this cannot be prevented by suitable diet, an injection of a pint of cool water may be used each morning. If medicines must be resorted to, they should be mild laxatives, such as calcined magnesia, compound licorice powder, Seidlitz powder, Rochelle salts, the liquid citrate of magnesia; a few prunes that have been stewed in an infusion of senna, eaten in the evening, will in some cases prove an efficient means of removing the constipation; so too one of the mild aperient waters, such as Hunyadi, may be used. All drastic purgatives should be avoided. If the constipation be associated with hemorrhoids, Dr. Fordyce Barker[1] advised a grain of aloes made into a pill with soap, hyoscyamus, and ipecacuanha and given night and morning. Cazin[2] commends a pill containing one or two centigrammes of belladonna given daily, as advised by Bretonneau.

Hemorrhoids. In addition to correcting constipation by the means just mentioned, half a pint of cold water should be injected into the rectum morning and evening, the injection being retained. When the piles protrude and are painful they may be bathed with warm water and laudanum, or the ointment of galls and opium may be applied. Dr. Bartholow[3] speaks favorably of the following ointment, advised by Oesterlen, for hemorrhoids: Pulv. gallæ, ℈j; pulv. opii, grs. x; ung. plumbi subacetat., ℈ij; ung. simplicis, ℥ij. M. The protrusion should be reduced as soon as possible.

Œdema of the Legs—Varices. The former is in many cases a consequence of the latter. It usually disappears after lying down for a time, and is to be treated by position, by removing all constriction, as from garters, and by bathing with cool water. Varices, according to Budin, occur in twenty to thirty per cent. of pregnant women; but in many cases the dilatation of veins must be very slight if there be so large a percentage; my own observation leads me to believe that only from five to ten per cent. of women are thus affected in pregnancy. Varices of the lower limbs are treated by position and compression. Cazin[4] advises the application first of an old linen bandage, and over this one of flannel extending from the toes to a point above the enlarged vessels. Some prefer an elastic stocking, but a flannel bandage is less expensive, and properly applied more comfortable. It is to be remembered that too great compression has caused abortion. An accident to which the patient is liable, either from violent scratching, from a blow, or sometimes simply from the pressure of the column of blood in unsupported vessels, is a rupture of one of them, permitting a hemorrhage rapidly fatal if the flow be not promptly arrested. The patient is informed of this danger, and told, if the accident occur, to lie down at once and stop the flow by firmly pressing her finger upon the bleeding point.

Pruritus of the Vulva. Itching of the vulva is a symptom of various conditions, such as œdema, follicular inflammation, eczema, herpes, or prurigo, etc. It is not remarkable that the external generative organs, sharing in the increased supply of blood occurring in pregnancy, and in some cases the seat of passive congestion caused by the

[1] Puerperal Diseases.
[2] Archives de Tocologie, 1881.
[3] Materia Medica and Therapeutics.
[4] Op. cit.

enlarged uterus, should be liable to some of the local affections mentioned, and which have as their most prominent symptoms a more or less intense itching. The violent rubbing and scratching which the pruritus may cause of course aggravate the disease. The irritation sometimes extends to the vagina, but it usually occupies only the great and less lips. The vulval inflammation from which the pruritus results may be caused by a vaginal discharge.

The suffering of some pregnant women from pruritus is often very great. Dewees has spoken of a woman under his charge thus afflicted, who was confined to her room during three months of her gestation, and whose only relief in her entire period was had by the nearly constant application of ice-water.

He also described an aphthous eruption as present in some cases, and for this he advised a strong solution of borax; it may be used for bathing the vulva, and also for injecting in the vagina, and frequently proves quite beneficial.

Some patients find relief of the itching by applying to the vulva cloths wrung out of hot water.

Dr. Tauszky recommends the application with a brush to the affected parts eight or ten times a day of the following solution, first suggested by Hufeland: two drachms of powdered gum-arabic, one of balsam of Peru, one and a half of oil of almonds, and one ounce of rose-water.

Bulkley advises an ointment, made by rubbing together one drachm each of camphor and chloral, and then incorporating the mixture with eight ounces of ointment of rose-water. Doubtless cocaine ointment or solution would prove useful. Spiegelberg found the most reliable remedy a solution of corrosive sublimate, applied 1 to 3 times (1 : 100–200 parts of dilute alcohol), followed by the application of tar-water, and by chamomile hip-baths. Tarnier also prefers a solution of corrosive sublimate, 2 parts; alcohol, 10 parts; rose-water, 40 parts; and distilled water, 450 parts. This lotion is employed undiluted morning and evening.

But, as observed by Olivier,[1] if the parts are inflamed, in some subjects mercurial lotions cause great suffering. He also states that in a series of cases he has had prompt success from the lotion of Delpeyrou, which is composed of hydrate of chloral, boric acid, glycerin, alcohol, and water. Unfortunately the formula for this lotion is not given, and Mr. Morgan, a prominent pharmaceutist of this city, suggests the following: Chloral, 2 drachms; glycerin, 4 drachms; alcohol, 4 drachms; boric acid, 1 drachm; and to these sufficient water is added to make four ounces. The parts are first washed in water as hot as can be borne, and then the lotion, diluted with an equal quantity of water, is applied by absorbent cotton; a thin layer of cotton, after being dipped in the solution, is interposed between the labia. The application may be made two or three times a day.

Herpes Gestationis. Bulkley has described this affection as beginning with clusters of vesicles upon the extremities, whence extension to

[1] Op. cit.

the trunk occurs. The disease does not disappear until after labor, and may recur in subsequent pregnancies; the treatment does not differ from that usually required by herpes.

General Pruritus. This, like the last, is a comparatively rare affection. It is characterized by intense itching of the skin, without any eruption being present to explain it. In a case narrated by Spiegelberg the pruritus began in the second month of pregnancy, and lasted until labor, being only partially relieved by Fowler's solution. Stoltz gives two cases. Probably arsenic or sulphur internally, and alkaline or mercurial lotions, may effect slight mitigation in some cases. The affection may be so serious, depriving the patient of rest, and causing such rapid deterioration of health and so great emaciation, that the question of ending the pregnancy is presented.

Neuralgia. This is more frequent in pregnancy than in the non-pregnant state, and may require the administration of tonics, especially of quinine and iron, and the use of anæsthetics locally; in some instances the suffering demands morphine hypodermatically, but usually phenacetin or antipyrin will relieve. Odontalgia is so common in pregnant women and the pain may be so severe that extraction of an offending tooth is too often done, and hence the familiar adage, "for every child a tooth." Marshall states[1] that softening of the dentine is not uncommon in pregnancy, and caries may result. He holds that long, tedious operations, like the restoration of form in decayed teeth with gold, are inadmissible during gestation. "All operations upon the teeth at such times should be as free from pain and fatigue as is possible, from the fact that in certain cases miscarriage might be the result." He advises as means preventive of caries a thorough and frequent use of the toothbrush and floss silk at least three times a day, supplemented by tooth-powders and antacid mouth-washes.

Gingivitis. Pinard first drew attention to gingivitis in pregnant women. This affection is characterized by redness and swelling of the gums, more especially of the anterior maxillary bones—indeed, in the vicinity of the molars the disease does not appear; the swollen parts readily bleed upon touch, and the corresponding teeth may become quite loose. Gingivitis is manifested about the fourth month of gestation, and having once appeared does not entirely go away until after the pregnancy ends.

The treatment consists in the thorough cleansing of the teeth, the removal of tartar, and the diligent use of the tooth-brush. Should these means fail, the use of astringents, such as tincture of myrrh and water, would be indicated. Tincture of iodine locally used has been recommended. Pinard advises applying to the diseased gums a solution of equal quantities of hydrate of chloral and tincture of cochlearia, the application being made every day or once in two days.

Sleeplessness. If this cannot be remedied by hygienic means—such as taking only a light supper, exercise in the open air, and a sponge-bath before retiring—and if caused by no obvious physical disorder which can be corrected, one of the alkaline bromides may first be tried alone,

[1] Journal of the American Medical Association, February 22, 1890.

and should this fail chloral may be combined with it. Opium is in some cases necessary, but great care must be taken that it is not given so frequently the habit of using it is formed.

The obstetrician will visit the pregnant woman from time to time, especially during the latter weeks of gestation, so that he may know her condition is favorable for her approaching trial. Once a week, during the last two or three months of gestation, the urine should be examined with reference to possible albuminuria; the examination must be made earlier if any symptoms, hereafter to be mentioned, indicate the probability of this disorder being present.

Few women, if a proper explanation be given, will object to an external examination made in pregnancy for obstetric diagnosis. Certainly such examination is advisable in most cases; and in some, if there is the least suspicion of an unfavorable presentation, must be insisted upon. Moreover, if the history of previous labors indicates any pelvic deformity, or there may be other reasons for suspecting such condition, the examination must be not only external but also internal.

In lying-in institutions careful pelvic measurements are made in the case of a pregnant woman, and hence when serious deviations from the normal are discovered in time, appropriate means to avert danger to mother and child are taken. The pregnant woman in private practice, and her unborn child, are entitled to quite as great prophylactic care. I know that occasionally a mother perishes in labor, and her child, too, because of the failure of the obstetric attendant to know in time the existence of a pelvic deformity.

SECTION II.

THE PHYSIOLOGY OF LABOR.

CHAPTER X.

CAUSES OF LABOR—PRECURSORY SYMPTOMS—PHYSIOLOGICAL PHENOMENA—CHANGES IN THE FORM OF THE HEAD IN VERTEX PRESENTATION—CAPUT SUCCEDANEUM.

Labor, the physiological end of pregnancy, is the process by which the fœtus and its appendages are separated from the mother; it is travail, bringing forth. Nature's design being the continuance of the race, the fœtus must have reached such development before its expulsion as to be *viable*, that is, capable of living external to the mother. If, therefore, the product of conception be expelled before such capability, the process is not called labor, but *abortion* or *miscarriage*. If labor takes place in the eighth or ninth month, it is called *premature*, because the fœtus has not attained its perfect development; if labor be deferred beyond nine months, it is called *postponed* or *delayed*, if the fœtus is alive, but *missed* labor if it is dead. When parturition is effected by the sole power of the maternal organism it is called *natural;* but if art aid or replace that power, it is termed *artificial* labor. In order that a labor may be natural the fœtus must not exceed the normal size and the presentation must be favorable; the birth-canal must be typical in size and form; and, finally, the forces, voluntary and involuntary, of the mother must be able to dilate the birth-canal, mould the presenting part, determine changes in its position so that shorter fœtal diameters are brought in relation with longer diameters of the mother's pelvis, the passenger thus accommodated to the passage, and all resistance overcome.

Determining Causes of Labor. For a long time it was believed that the fœtus escaped from the uterus by its own efforts, just as the chick leaves its shell, or the butterfly its cocoon. Harvey, for example, held that "the fœtus, with its head downward, attacks the portals of the womb, opens them by its own energies, and thus struggles into day."

If the fœtus made its own way from the mother's womb, the question naturally arose as to the reason for its action, and various answers were given. The amniotic liquor became acrid, and irritated the skin of the fœtus; Drelincourt said that the intestine was filled with meconium, and hence a colic which disturbed the fœtus, and made it strive to get out, while others held that a distended bladder was the cause of this effort; the womb became too hot for it, or it needed to breathe, or

sought different food; Fabricius asserted that the weight of its head pressed open the mouth of the uterus. Some thought that obliteration of the utero-placental vessels caused the child to leave, others that the uterus having reached a certain distention, reacted and by its contraction incommoded the fœtus; narrowing of the ductus arteriosus, of the ductus venosus, and of the foramen of Botal have also been suggested as the causes of the action of the fœtus.

Those who believed that the fœtus was an active agent in parturition asserted that the delivery of a dead child was more difficult than that of a living one. Admitting the assumption, Depaul has suggested three answers: First, the living fœtus by its movements may excite or increase uterine contractions. Second, in case the fœtus dies, some time may elapse between the death and the expulsion, but the development of the uterus ceasing with the former, its action in the latter may be less powerful than it is at the time of perfect development. Third, if the membranes have been ruptured, the following fœtal decomposition may have a poisonous influence upon the muscular fibres of the uterus, weakening their action.

Post-mortem births have been claimed as proof that the fœtus could escape from the womb by its own efforts. But when these happen soon after death they result from the persistence of uterine contractility, while the resistance of soft parts is lost; occurring later, they are caused by the pressure of gases formed in the abdomen external to the uterus.

Fatty degeneration of the decidua, by which the ovum is detached from the uterus and becomes a foreign body, is alleged by some to be the cause of labor. It is well known that artificial detachment of the ovum is one of the most certain methods of inducing labor. But the fatty degeneration which is supposed to excite natural labor is not a constant fact.

The influence of the ovaries in exciting labor has been maintained. Tyler Smith believed he had established that ovarian excitement is the law of parturition in all forms of ovi-expulsion; this excitement, this nisus, he alleged, is active at monthly periods through the pregnancy, becoming at the tenth so great as to cause labor. Probably the majority of women are not conscious during their pregnancy of periodical ovarian disturbance; in the order of nature ovulation is then suspended, the ovaries, for the time being having fulfilled their work, now rest. Besides, the tenth period varies in different women; in one menstruating every thirty days it is three hundred days, while in another who has her flow every twenty days, it is only two hundred. Again, women may conceive who never menstruated, or in the physiological absence of the flow during lactation; a nisus which fails to cause menstruation in the non-pregnant state has not enough power to start the machinery of child-birth. Single ovariotomy has frequently been done during pregnancy, and labor occurred at the normal time. Double ovariotomy has been done in a few cases in pregnant women, but this did not delay or prevent the action of the uterus occurring at the normal end of gestation.

But if the determining cause of labor be not found in the fœtus or in changes in the decidua or in the ovaries, may it not be in the uterus? It is held by some that when the muscular fibres of the uterus have attained their perfect development, expulsive contractions result. But

the contractile power of the uterus is manifested in premature labor and in abortion. Others teach that the uterus may be distended to a certain degree, and then reacts against the distention. But the thickness of the uterine walls is different in different subjects, and in the same subject varies in different pregnancies, yet in each case the reaction occurs just when the fœtus has reached maturity. In plural pregnancy and also in polyhydramnios the uterine distention is greater than in single or in normal pregnancy.

Brown-Séquard has shown that carbonic acid circulating in increased quantity in the blood of a pregnant animal causes uterine contractions, and the occurrence of labor is therefore attributed to the accumulation of carbonic acid in the venous apparatus of the uterus. Dr. Robert Barnes[1] has called attention to the fact that when the French army in Algeria kindled fires at the mouths of caves in which, among others, a number of pregnant women had taken refuge, almost all these women miscarried. But it is possible that mental emotion had as much to do with the accident as carbonic acid. The carbonic acid hypothesis of the induction of labor fails, because it does not explain why the uterine muscular tissue did not act sooner, but was indifferent to the presence of carbonic acid until nine months ended, and then suddenly resented and began the process of labor.

Leopold finds the source of the irritation which leads to uterine contractions in the increased venosity of the blood in the maternal or fœtal placenta, resulting in venous thromboses of the serotina or in the uterine walls.

Dubois and Depaul upheld a theory first advanced by Power in 1819. According to it, the expulsion of the fœtus is similar to that of the feces or of the urine. Feces accumulate in the rectum, and after a time by pressure on the sphincter irritate it, until reflex action determines contractions which overcome its resistance, and the bowel is emptied. So, too, the renal secretion does not at first excite vesical contractions; but when the reservoir is more or less completely filled the fibres of the neck are stretched, causing irritation and dragging on the sphincter of the organ, and this sensation reacting upon the body, contraction is excited and its contents discharged. In pregnancy the upper part of the uterus is developed first; "little by little the lower segment takes part in the general development of the organ, and the ovum gradually occupies a larger space in this portion; thus at the ninth month that section of the uterus adjoining the internal orifice of the neck is developed in turn, and causes stretching of the circular fibres; this purely mechanical irritation, by reflex influence, acts upon the upper part of the womb."[2]

But, as frankly acknowledged by Depaul, the theory of Power fails to explain the access of labor-pains in extra-uterine pregnancy.

[1] Transactions of the American Gynecological Society, vol. i.

[2] Depaul, op. cit. Garimond, Nouv. Arch. d'Obstét. et de Gynécol., 1887, in a study of the determining cause of labor, referring to the analogy between the expulsive exertion action of the bladder and that of the uterus, observes that it is not irritation of the sphincter, but excessive tension of the entire cavity of the bladder that causes this organ to contract, expelling its contents; and thus in regard to the uterus: tension of the uterine walls is the cause of uterine action beginning, and contractions occur, not in response to an elective sensibility seated in the body or neck, but this sensation belongs to the entire physiological organ. This is simply an old hypothesis in new clothes.

Ahlfeld[1] regards the irritation which determines uterine activity as primarily originating in the lower uterine segment and cervix. These are greatly stretched at the end of pregnancy. Moreover, the parts of the birth-canal adjacent are rich in nerves, and especially at the anterior and lateral periphery of the cervix large numbers of ganglia cells are found. He refers to the inaugural dissertation of Knüpfer, at the Dorpat Klinik, 1892, in which careful study of the bat has proved the existence of vast numbers of ganglia cells in the peri-cervical tissue, irritation of which caused expansion of the lower uterine segment.

Some writers, plainly seeing the weakness of each of the various causes adduced as determining labor, have rested their explanation in a combination of them.[2] It is better to refer the matter to a law of the organism, a law the cause of which we do not know, for, as truly said by Foster,[3] we are utterly in the dark as to why the uterus, after remaining apparently perfectly quiescent, or with contractions so slight as to be with difficulty appreciated for months, is suddenly thrown into action, and within, it may be, a few hours gets rid of the burden it has borne with such tolerance for so long a time; indeed, none of the various hypotheses which have been put forward can be considered satisfactory.

The Efficient Causes of Labor. The chief agent in the expulsion of the fœtus is the uterus itself. During the first part of labor the uterine contractions act unaided; but when the os uteri is dilated so as to offer little or no resistance to the descent of the part of the fœtus which presents, they are reinforced by the action of the abdominal muscles. In exceptional cases, as in complete prolapse of the uterus, or when the patient is paraplegic, or profoundly narcotized, uterine contractions have alone effected delivery, but the labor under these circumstances is, as a rule, longer.

Precursors of Labor. In some cases labor begins abruptly—the patient, for example, being wakened in the night by frequent and strong uterine contractions. But in the majority a change in the form of the abdomen, increased secretion from the external organs of generation at first, and then from the glands of the neck of the uterus, swelling of the labia, and the hitherto painless contractions of pregnancy becoming more frequent and causing some discomfort, prepare the way and herald the coming of labor. The first of these phenomena is not constant; it results from the head of the fœtus covered by the inferior segment of the uterus and more or less of the expanded upper portion of the cervical canal entering the pelvic cavity, while the superior portion of the uterus inclines more in front and is lower. By this descent or settling down of the uterus—falling of the abdomen it is sometimes called—the patient's waist is not so large, her breathing is less interfered with, she can take a fuller inspiration, and her stomach, relieved from pressure, receives more food; on the other hand, the increased downward pressure may cause irritability of the bladder or of the rectum, difficulty

[1] Lehrbuch der Geburtshilfe, 1894.

[2] Their explanation has always seemed to me similar to the statement of the physician who combined many medicines in his prescription, "so that the disease might take whichever it liked."

[3] Text-book of Physiology.

in walking, and greater swelling of the lower limbs. This change in the form of the abdomen is marked in the primigravida, but may fail in the multigravida, for the uterus and the abdominal wall of the latter having undergone development in one or more previous pregnancies, yield more readily, the uterus does not rise so high, and is more inclined forward earlier in pregnancy. In cases presenting this phenomenon[1] its value as a sign of approaching labor is not great, for while it usually occurs from one to two weeks before, this interval may be only a day or two, or it may be a month. It is a favorable indication as to the labor, for it shows that the presentation is normal and the pelvis roomy.

Active hyperæmia and passive congestion, the latter resulting from pressure, cause more abundant secretion from the glands of the cervix. This discharge is viscid, yellowish, and in some cases toward the end of pregnancy contains striæ of blood; when thus stained, its color being caused in the same manner as that of the sputa in pneumonia according to Velpeau, it is known in the lying-in room as a "show," and is then usually an indication of considerable advance in labor. It is caused, whether occurring at the end of pregnancy or in the beginning of labor, by partial detachment of the decidua near the mouth of the womb. The striæ of blood observed at the close of the stage of dilatation of the os uteri result from slight lacerations of the cervix. An abundant discharge from the cervical glands is a favorable indication as to the ready dilatation of the os uteri.

The external organs of generation are swelled and moistened by their own and by the vaginal secretions. The painless uterine contractions of pregnancy become more frequent, and begin to cause more or less discomfort. In the parous especially it is not unusual for these contractions to become decidedly painful some days before labor; they may come on at night disturbing the woman's rest, and making her believe labor is at hand, but disappear in the morning to be renewed the following night. When the cervix is effaced, and uterine contractions recur at regular intervals and cause dilatation of the os uteri, labor has begun.

STAGES OF LABOR. Although labor is one process from the beginning to the end, yet it is usual to consider it as including three stages or periods. The first stage, the uterine period, begins with dilatation of the os uteri, and ends when that dilatation is so complete that the head, or the greater part of it, can pass through the os uteri. The second stage of labor, the utero-abdominal period, then begins, and includes the expulsion of the child. The third stage, the placental period, embraces the detachment of the placenta, its expulsion from the uterus, and then from the vagina. While the boundary between the second and third stages is well marked, that between the second and the first is by no means so clear; theoretically, the line is as stated, but in practice one rarely sees it so sharply and abruptly defined—the first oftener gradually passes into the second stage.

[1] According to the investigations of Brül, in primigravidæ the greatest circumference of the fœtal head was found to have passed the brim at the end of pregnancy in half the cases, but in multigravidæ in one-fourth only; if the true conjugate is less than 10 centimetres, in only one-third.

Prof. Müller, of Berne, directs in those cases in which the head has not thus passed the brim at the end of pregnancy, to grasp the fœtus through the abdominal wall and force the head as far as possible into the pelvic canal.

Phenomena of Labor. These are usually divided into *Physiological* and *Mechanical.* A third class has been added by some, and are called *Plastic Phenomena;* by these are meant the fœtal form-changes produced in labor, and dependent upon presentation and position; they are the deformations which the presenting part of the fœtus undergoes in its transmission through the birth-canal; they disappear a few days after birth.

Physiological Phenomena. First. *Uterine Contractions.* As the contractions of the uterus are the chief power by which the fœtus and its appendages are expelled, their study is important.

Characteristics of Uterine Contractions. First. They are *involuntary,* that is, independent of the will; it can neither begin nor stop them. But though not subject to volition, they may be affected by mental impressions. Thus the presence of a person in the room of the parturient who is disagreeable to her, one for whom she has an antipathy, may interfere with their regular action and power, while they may be immediately arrested by the arrival of a stranger who takes the place of the expected family physician. Profound mental anxiety, grave apprehension of disaster, and deep sorrow may lessen the activity of uterine contractions.

Second. These contractions are *peristaltic.* The most probable view, derived from observations of inferior animals, is that the peristaltic movements begin at the fundus of the uterus.

Third. The contractions are *intermittent.* The periods of action and of rest are different in different stages of labor. The contractions last about twenty seconds at the beginning of labor, and the intervals are twenty or thirty minutes; toward the close of the second stage of labor the former may last a minute or more, while the latter only two or three minutes, sometimes less, but during it the intervals are about five minutes. In some cases the uterus, after having manifested active contractions for a few hours, pauses in its work, and a rest of some hours may follow, after which its action is resumed with new vigor. Such a pause, therefore, neither the condition of the mother nor of the child indicating the demand for interference, should not be considered pathological. The ordinary intermittence in the succession of uterine contractions is important both for the mother and for the child; the latter is saved by it from a continuous pressure which would cause asphyxia, and the former has her burden of suffering divided into many parts which can therefore be endured, while united they would be too heavy for human tolerance; and beside, such continuous and concentrated action would produce injurious pressure upon her tissues, and render rupture of the uterus almost inevitable. The intermittence of uterine action corresponds with that observed in other organs, *e. g.*, the heart, the lungs, the intestines, etc., and the noblest human organ, the brain, has a period of activity followed by one of repose; alternate work and rest seem to be the law of life. The contractions do not begin and end abruptly, each gradually reaches its maximum and then declines—a climbing, and then a falling wave; but in the latter part of labor this characteristic becomes much less marked.

Fourth. The contractions of the uterus are associated with changes

in its form and in its position. During a contraction the organ takes a cylindrical form; its transverse diameter is notably lessened, while both the longitudinal and the antero-posterior are slightly increased; the shortening of the transverse diameter produces some extension of the fœtus, its curved form is lessened, and hence the slight increase in the longitudinal diameter of the uterus. The broad and round ligaments contracting simultaneously with the uterus press it toward the pelvis; the round ligaments contracting draw the organ forward, so that the fundus rests upon the abdominal wall.

Fifth. The power of the contractions is in proportion to their frequency and the resistance; it increases with the progress of the labor, the duration of contractions being inversely proportionate to the intervals. The force and frequency of uterine contractions are not in all cases in relation with the general vigor of the subject; these contractions may be strong and frequent in feeble, delicate women, while weak, and the intervals long, in the robust.

Sixth. The character of the contractions is related to the presentation. Depaul has especially drawn attention to this fact, stating that the contractions are usually more regular and effective in presentation of the vertex. Uniform pressure upon the lower uterine segment and the dilating os seems necessary in order to evoke the regular and strong action of the body and fundus of the uterus; this condition cannot be met by presentation of the face, of the breech, or of the shoulder, and hence the contractions present a manifest irregularity. The physiognomy of the labor will in most cases give a valuable indication as to the part of the fœtus which presents.

It is not uncommon to find the contractions alternating in strength, a vigorous contraction being followed by a feeble contraction, and *vice versa;* they then come in couples. One of the characteristics of uterine contractions is that they are painful, but the subject of pain in labor will be considered in another connection.

Force of Uterine Contraction. Many endeavors have been made to ascertain the force exercised in labor. These have been by measuring the bulk and extent of the voluntary and involuntary muscles concerned in the function (*Haughton*); by determining the force necessary to rupture the fœtal membranes (*Poppel* and *Duncan*); by means of the tocodynamometer (*Schatz*); and by the tocograph (*Poullet*).

Haughton's estimate was 577.75 pounds, which exceeds that quoted by Sterne in *Tristram Shandy*—"470 pounds avoirdupois acting upon the head of the child." Poullet's conclusion[1] is that the maximum force of expulsion is about 50 pounds. Duncan states that in easy labor a force scarcely exceeding the weight of the child is necessary, while only a few difficult labors require for their whole work a force exceeding 50 pounds; and admitting the force asserted by Haughton, he adds the child would be shot out of the vagina at the rate of 36 feet per second. Schatz's estimate is from 17 to 55 pounds. Ribemont has repeated the experiments of Duncan, and has found that with the mem-

[1] Poullet (Archives de Tocologie, 1880) refers to Tristram Shandy as an English author, and speaks of Professor Haughton as "one of his compatriots," a ludicrous mistake, into which more recently Delore and Lutaud (Traité Pratique de l'Art des Accouchements, Paris, 1883) have been led.

branes presenting a surface of 10 centimetres, the pressure necessary to rupture them was 10 kilo.; the maximum, 11 kilo. Spiegelberg regarded all estimates as liable to errors—*e. g.*, that derived from the resistance of the fœtal membranes in labor to this, that the water in front of the presenting head is not subjected to the same pressure as the other uterine contents, while the manometric method is liable to mistakes in measurement. It cannot, therefore, be claimed that we know the entire force, or that which is its chief element, the contraction of the uterus as exerted in labor.

Abdominal Contractions. When the mouth of the womb is so dilated as to offer little or no resistance to the escape of the presenting part, the first stage of labor ends, and the second, or the utero-abdominal period, begins. The uterine contractions are now reinforced by voluntary contractions of the muscles of the abdomen. Preparing for one of these efforts, the patient bends forward, fixes her body by pressing the feet against a firm object, possibly grasps the bed or another's hands, takes a deep inspiration, pushing the diaphragm down, and the glottis is closed; the abdominal muscles are now firmly contracted, thus lessening the size of the cavity; the pressure from this contraction is exerted uniformly upon the contents; it is resisted above by the depressed diaphragm, and behind by the immovable spine; it acts uniformly upon the uterus, forcing it downward, and is transmitted to its contents. This force not only assists that of the uterus, but also acts as a counterforce to uterine contractions, which, when violent, might, were it absent, cause rupture of the vagina at its uterine attachment.

While, during the greater part of the second stage of labor, the action of the abdominal muscles is voluntary, it generally happens that toward its close, just when the fœtal head is about to be expelled from the vulva, the patient cannot refrain effort, and the hitherto voluntary action becomes purely reflex.

The Third Stage. In ten to twenty or thirty minutes after the birth of the child uterine retraction, which detaches, and then uterine contractions, which expel the placenta into the vagina occur; they may be assisted by voluntary contraction. So, too, these uterine and abdominal contractions, assisted in some slight degree by the elasticity and contractions of the vagina, may thrust the placenta without. This topic will be considered more fully hereafter.

Pain. Labor begins, continues, and ends with pain: "childbirth is the only necessarily and invariably painful function of the species." While in very rare cases delivery is without suffering, yet these are exceptional, for now, as of old, the law[1] is, "in sorrow thou shalt bring forth children." But pain is relative; there is no measure of this phenomenon of vital sense which can be universally applied. One patient will be in restless agony in childbirth, vexing the air with her outcries, while another lies comparatively quiet and suffers in silence, because sensation, power of endurance, and force of will so greatly differ. Nevertheless, pain is not so great in the parous as in the primipara; yet how often the former will declare that they suffer more in

[1] Dr. Richert has said: Pain is an intellectual function so much more perfect as the intelligence is more developed.

the present than in a previous labor, simply because of that beneficent law of the economy which leads human beings to forget painful sensations. The occurrence of pains during uterine action in labor is so constant that the name is generally, and in almost all languages, used as a synonym for uterine contractions. But the duration of a contraction and of a pain is not the same; while the former causes the latter, the contraction can be readily recognized by the obstetrician with his hand upon the patient's abdomen, or with his finger at the os uteri, before she complains of any suffering, and he likewise knows by the same means that it continues after all complaint has ceased; pain comes after contraction begins, and goes before it ends.

CHARACTER OF THE PAINS. In the beginning of labor these are felt as a disagreeable pressure downward in the pelvis, later they are felt in the lumbar and sacral region, radiating thence to the pubes, so that the patient is girdled with pain. At first they do not by their frequency or their severity hinder a patient's being engaged in such occupations as reading, sewing, conversing, etc., only when one occurs she pauses for a minute or two, a slight change of expression is noticed, a mere cloud passes over her face, she bends her body forward during the brief suffering and then resumes her conversation, reading, or work. The bending forward is instinctive, and is said to be an effort to withdraw the ovum from pressing directly upon the lower segment of the uterus; but it is probable that the movement is made in response to the anterior and downward positional change of the uterus, caused by the contraction of the broad and round ligaments, and to lessen the pressure upon the abdominal wall, just as more common abdominal pain leads to a similar movement.

During the first stage of labor the pains are spoken of by the sufferer as "cutting," "grinding," etc., but by the obstetrician as dilating, or preparatory. As the frequency and intensity of the uterine contractions increase so are the pains more severe; the patient may become restless, irritable, despondent, and discouraged, asserting that she suffers in vain, "the pains do no good," "the child will never be born," and she knows she will die. After a time, when the os has become fully dilated, and the birth-canal is thus prepared for the descent of the child, expulsive, or "bearing-down," pains occur. The transition is not sudden but gradual, the call for voluntary effort is at first indistinct, and partly from this, and partly because the patient fears lest such effort may add to her suffering, the response begins in a hesitating, tentative way, and then gradually becomes equal to the demand. Hitherto the patient has been without power to assist the progress of labor—she has had only to endure, to suffer—but with the establishment of the second stage active duty devolves on her, and she usually becomes hopeful and resolute; no longer moaning and groaning, her lips are closed while voluntary abdominal pressure combines with uterine contraction to drive the fœtus down the birth-canal, abrupt expiration occurs at the close of a pain, with a sudden and guttural outcry. The practitioner soon learns to know by a patient's cry whether she is in the first or second stage of labor.

THE SEAT OF PAIN. Madame Boivin, who knew from personal

experience the suffering of childbirth, thought the pain was almost entirely the result of stretching the os uteri. Depaul said that in the first stage of labor it was in the lateral and lower parts of the uterus, but afterward it arose from pressure of the fœtus upon the organs and tissues of the pelvic cavity. According to Spiegelberg, form-changes in the uterus and of separate muscular fasciculi in its walls, permitting pressure on nerves, are causes of suffering. The pressure upon the tissues surrounding the vulval orifice made during its dilatation also causes severe pain.

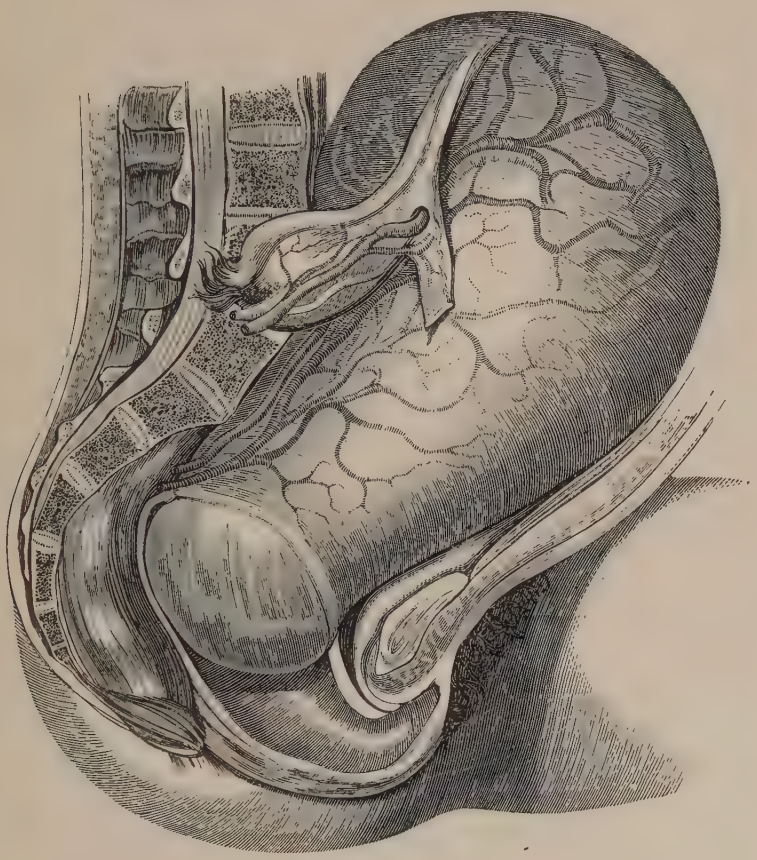
Dilatation of the Os Uteri. At the beginning of labor the cervix has disappeared, only a slightly projecting border—more pronounced in multiparæ—marking the boundary of the os uteri. This is the first barrier to the escape of the fœtus, and dilatation of the os, therefore, is the first part of labor. This dilatation is at once active and passive; the muscular fibres of the body and the fundus overcome the resistance of the circular fibres of the os, and the pressure of the ovum upon the os, made by the projecting membranes filled with amnial liquor —the bag of waters—mechanically dilates it. Further, this uniform pressure of the ovum upon the lower segment and mouth of the womb evokes regular and stronger contractions from the body and fundus; and thus, in addition to its mechanical dilatation, assists labor. When the uterus contracts the cavity lessens, its walls tend to approach a common centre; but the ovum resists, and the resultant of the forces developed by the contracting muscular fasciculi is transmitted in the direction of least resistance, that is, to the os uteri, from which a part of the ovum, this part increasing with the progress of the labor, protrudes. As the os uteri expands the cavity lessens; and the former, by the contraction of the longitudinal fibres of the uterus tends to ascend, drawn up over the ovum or the presenting part. At the beginning of a contraction the rim of the os uteri becomes thicker, irregular, as if "puckered," and the opening smaller, but with the progress of the uterine effort the border becomes thin, irregular, uniform in thickness, and the opening expands; with the advance of the labor the lessening of the os at the beginning of a contraction is not observed, but dilatation alone.

In primiparæ the border of the os uteri is at the beginning of labor very thin, scarcely thicker than parchment, is closely applied to the fœtal head, and during a uterine contraction seems like a tense cord; but with the progress of the labor it becomes thicker and swelled, especially at the anterior part, and it is more dilatable; it never, however, becomes so thin as it was at first.

The dilatation rapidly increases with the progress of the labor, nearly as much time being needed for the os to be stretched to the size of a silver dollar, as from this to reach complete expansion. The process is more rapid in the parous than in the primipara. At the beginning of labor the os is usually posterior and to the left; but with its progress it comes nearer the centre; its form is at first circular, then oval, the large end of the oval being to the left and somewhat behind. The posterior lip generally yields before the anterior, the uterine orifice being nearer to the sacrum than it is to the pubes; if the labor be prolonged, the anterior lip in most cases becomes œdematous.

THE BAG OF WATERS. The ovum being equally pressed at all points except at the os uteri projects there, and that portion of the membranes containing amniotic liquor thus protruding, "making a hernia through the more or less dilated os," is the bag of waters. The size and form of this protrusion are usually dependent upon the degree of dilatation and upon the presentation. When the os is but slightly dilated the bag of waters is small; so, too, in vertex presentation it is at first little, and has the form of a watch-crystal, but as the dilatation ap-

FIG. 106.



THE BAG OF WATERS.

proaches completion it is large, and is hemispherical. The bag is great in presentation of the face, of the breech, or of the shoulder, because no one of these parts can be adapted to the cervico-uterine canal, but permits the amnial liquor to pass freely by it; the great size of the bag of waters rather than the form is an indication of an unfavorable presentation, especially when this is observed during the dilatation of the os uteri, and the presenting part of the fœtus does not readily descend. A double bag of waters is observed in some cases of twin pregnancy.

The pouch is smooth and tense during uterine contractions, relaxed and yielding in the intervals. Tarnier's experiments have proved that the membranes are permeable by fluids, so that a moist condition of the vagina is not a proof of rupture of the sac. The bag of waters acts as a hydrostatic dilator of the os uteri, the best and the least painful one; and therefore care must be taken to guard against its premature rupture. In some cases rupture takes place before labor, or as the first indication that labor has begun, the patient being awakened from her sleep in the night by a gush of water; this accident is more frequent in primigravidæ than in multigravidæ, because in the former the uterine walls are more resisting, and yield less readily to distention. When the waters are evacuated before or at the beginning of uterine contractions the labor is called a dry labor, and the first stage is generally quite tedious.

A collection of fluid between the ovum and the uterus or between the amnion and the chorion may take place, and its discharge simulate that of the amnial liquor; when this occurs the flow is known as the "false waters,"[1] and probably most of the cases in which it is thought that the ovum was ruptured sometime before labor are thus explained. This last statement, however, does not apply to all, for there are authentic cases in which the rupture took place some weeks before labor. Poullet, quoted by Tarnier, gives one instance of rupture six weeks, another nine weeks before labor, and then a living fœtus being born in each case. Matthews Duncan mentions an instance in which the pregnancy continued for forty-five days after the first discharge of amnial fluid; he also states that a medical friend, mistaking pregnancy for an ovarian dropsy, performed paracentesis, drawing off a large quantity of amnial liquor, when he desisted because feeling the fœtus strike against the canula, and yet the pregnancy did not end for a month. If one is in doubt whether the fluid discharged in a given case be liquor amnii, and enough of it can be collected for examination, the presence or absence of sebaceous matter promptly settles the question.

In rare instances, less rare in premature than in mature labor, the ovum is expelled entire. Under these circumstances the membranes were known as a child's *caul*, which once was in demand by sailors as an amulet that would keep its possessor from drowning. Formerly, when the child was born with a flap of membranes covering the head, the fact was regarded as a favorably augury.[2]

The bag of waters is usually spontaneously ruptured about the time the os uteri is fully dilated; in some cases, however, it may protrude from the vulval orifice before being torn. As a rule, the rent is at the most dependent part of the pouch, and the water escapes suddenly and with noise; but it may be above in the cervico-uterine canal, and the flow is gradual and silent, while the part of the membranes in front of the child's head being entire still forms a pouch. The quantity of fluid discharged depends upon the presentation; thus if the vertex present, the head makes a ball-valve which, when pressed down during a

[1] These discharges are generally caused by catarrhal endometritis.

[2] Caul on the Head. In Dean Swift's Polite Conversations one of the female characters remarks to a gentleman, "I believe you were born with a caul on your head, you are such a favorite with the ladies."

uterine contraction entirely arrests the flow, and permits only a slight discharge in the interval; no other part of the fœtal ovoid which may present can so well fill the cervico-uterine canal, but by its irregular form readily permits the escape of the amnial liquor. It is often observed in vertex presentations that when the head has descended so that partial deflection—a movement which some authors describe in the mechanism of labor as *levelling*—can take place, there is an increased flow of liquor amnii, because the neck does not completely fill the canal.

It is very important for the obstetrician to know whether the membranes are ruptured. Generally there is no difficulty in deciding this question, but cases occasionally occur in which it is very great, and some deplorable mistakes have been made; thus the forceps has been applied to the fœtal head enclosed in the membranes, the distended bladder has been thought the bag of waters and incised, causing a vesico-vaginal fistula, and the fœtal scalp similarly mistaken and treated in like manner, the incision being the starting-point of a fatal erysipelas. A knowledge of the fact that such errors have been committed, and hence the possibility of their repetition, may prove a warning against the hurried and imperfect examination in which they originate. In doubtful cases the obstetrician should examine during a pain—of course, taking care to avoid rupture of the pouch if it be present—for, however closely the membranes may be applied to the head when the uterus is at rest, there will then always be found some fluid interposed which causes their projection. In the interval between pains the membranes are flaccid, and the finger can press them in wrinkles or folds which give a different sensation from that caused by directly touching the fœtal scalp. Finally, Charpentier advises carrying the finger as far as possible between the head of the fœtus and the cervix, thus opening a way by which, if the membranes have been ruptured, the liquor amnii will flow down into the palm of the hand.

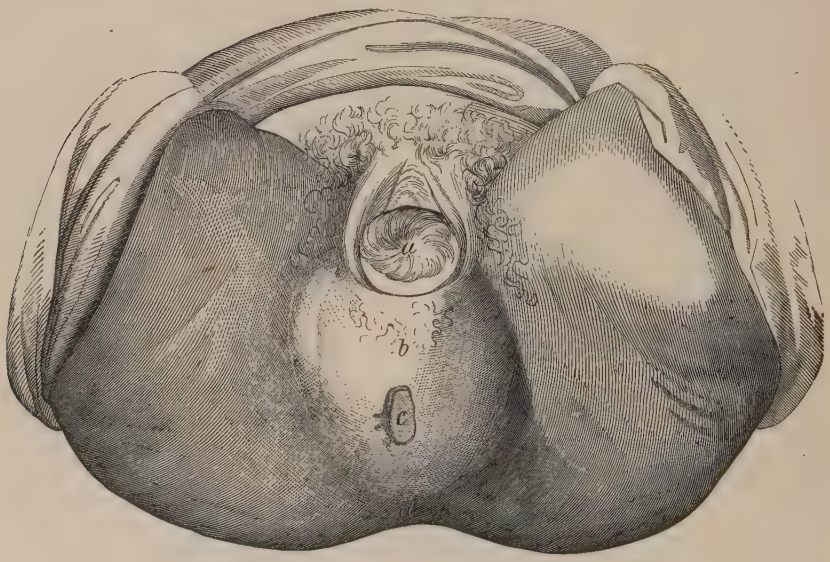
Muco-sanguineous Discharge. A greater discharge from the external genital organs and from the vagina is observed toward the close of pregnancy, but with the beginning of labor an increased secretion from the glands of the cervix occurs. The character of the latter, as well as the significance of the blood often found mixed with it, has already been stated; the discharge of any considerable amount of blood with it would indicate most probably either a serious rent of the cervix or a partial detachment of the placenta.

Dilatation of the Vagina. The upper part of the vagina is dilated by the descent of the lower portion of the uterus containing the fœtal head, and by the stretching of the margin of the os uteri, so that there is formed a complete utero-vaginal canal ample for the passage of the head; no resistance is presented until the inferior boundary of the vagina is reached; in primiparæ the hymen is an obstacle which is removed by a series of rents. Budin has shown that the vaginal orifice may present a resistance lasting some hours, which has been commonly attributed to the perineum; in one case in which there was delay from this cause, he incised the vaginal orifice, and the labor ended rapidly without injury to the perineum or to the vulva.

Dilatation of the Vulva. The head now enters the vulval

canal, the perineum is behind, the labia at its sides, and the uterine contractions, whose force is increased with the partial emptying of the uterus, and the abdominal, which are stronger from reflex irritation caused by the head pressing on the perineum, drive the presenting part like a wedge, widely separating the vulval walls. The perineum is greatly elongated and so thinned that the bones of the fœtal head may be felt through it; it is converted into a gutter, externally from side to side, and from before backward; its elastic tissue and muscles direct the head upward. Each pain pushes the head further, but it recedes in

Fig. 107.



Head at the Vulval Opening.[1]

the interval between pains—the parts are stretched and then relaxed; the anus is widely opened, and the anterior wall of the rectum exposed, making a part of the external covering of the fœtal head; the labia are separated by the head, more and more of this emerging at each contraction, which seems as if it were to be the last needed for its expulsion, until finally the parietal protuberances escape the rim of the vulva, and there is no more recession, for the bearing-down effort seems almost continuous, scarcely a pause for breath, until in a conquering agony and with the most intense suffering the head is born. A brief pause follows, and returning pains expel the body of the child; immediately following it the remaining portion of the liquor amnii, frequently some blood from a partially detached placenta with it, is discharged.

Detachment and Discharge of the Placenta. The separa-

[1] "In this figure, copied from Smellie, the child's head, *a*, is seen separating the labia; the extension, thinning, and protrusion of the perineum, *b*, caused by the head's descent, and called by some the *perineal tumor*, are also well portrayed; *d* marks the point of the coccyx; *c* the anus dilated, so that the inner membrane of the rectum is to some extent exposed to the contact of the hand, when applied for the protection of the structures. This exposure is not injurious; no harm arises from it; and sometimes it is even greater than is represented here." Ramsbotham.

tion of the placenta from the uterine wall has been differently explained, and probably does not always occur in the same manner, varying, too, according to the part of the uterus to which it is attached. If the placenta has its site at the fundus of the uterus, detachment may begin at the centre, and effusion of blood occur which by pressure continues the separation to the periphery of the organ. In one of Winter's frozen sections this mode of separation is shown, and it is that which is known as Schultze's. Necessarily there is inversion of the placenta in these cases, and the organ presents at the os uteri with its fœtal surface.

Ahlfeld[1] describes as the most frequent mode of separation, occurring in about 75 per cent. of cases, the placenta being situated at the anterior or posterior wall of the uterus, the central portion of the placenta is lifted off, and the retro-placental hematoma presses the under half of the placenta into the contraction-ring. The border of the placenta, perhaps also the adjacent portion of membranes, enters deeper, then the central part, finally the upper part of the placenta descends, until the inversion and the pressing out from the uterine cavity is completed.

Pinard and Varnier[2] state that the forces which cause placental detachment are the elasticity, the retractility, and the contractility of the muscular tissue of the uterus. "During and immediately after the expulsion of the fœtus the uterus tends to recover its form, that is to say, each part of its wall tends to approach the centre of the cavity. That portion of the wall which corresponds to the insertion of the placenta is more remote from this centre because of the presence of the placenta and of its less elastic force, retractile and contractile, for its wall is thinner. These muscular elements accumulated around the placenta exercise their action upon the thinned part and lessen its surface. It is easily understood that this action would be in direct proportion to the acting muscular mass, that is to say, the detachment will be made more quickly the thicker the uterine wall." The membranes remain adherent, except in the lower uterine segment; there they have been detached during labor. The weight of the placenta and uterine action determine the separation of the still adherent membranes. Pinard and Varnier say that "the plate of Schröder and of Schatz and their own conclusively prove that the placenta may be in the lower segment of the uterus and even in the vagina, suspended, as it were, by the membranes still retained and adherent in the uterine cavity." They add the important rule derived from this fact: Never begin or continue tractions upon the cord during uterine contraction, even though the placenta is already in the vagina or at the vulva. The consequence of such untimely traction will be the probable retention of fragments of the membranes in the uterus.

Berry Hart[3] maintains that the separation of the placenta is accomplished, not by contraction, but by expansion of the area of uterine attachment. "However much the area diminishes the placenta cannot separate, because the disproportion necessary cannot take place. When

[1] Lehrbuch der Geburtshülfe.
[2] Précis d'Obstétrique, by Ribemont-Dessaignes and Lepage.
[3] Selected Papers in Gynecology and Obstetrics. 1893.

the uterus contracts to the amount it does after the child is born the placenta fills the uterine cavity, and any further diminution in uterine bulk never leads to a disproportion between placenta and the area of the uterine muscle to which it is attached, but the two are always equivalent. After the pain has died off the uterus relaxes, and, as a matter of fact, has an increase in area in its anterior and posterior surfaces. Now comes in a different phase in the behavior of the placenta. The fœtal blood has been aspirated from it; the intervillous spaces are empty, and, therefore, during the increase in the internal uterine area, we have cut off the two factors in bringing about the equivalent expansion in area during the relaxation following the pains of the first and second stages, *i. e.*, we get the placenta smaller in area at the place of separation than the placental site. This repeated disproportion in area, *i. e.*, slight excess of area of the placental site over the placenta itself, tear the partitions in the spongy layer, *i. e.*, separates the placenta."

After the placenta is detached contractions of the body of the uterus drive it into the lower segment, whence the same force compels its passage through the os uteri. In this passage the fœtal face presented, according to the observations of Pinard and Varnier, 789 times in 1000 cases, the border of the placenta 166 times, and the uterine surface 45 times.

False Pains. It sometimes happens that women during the latter part of pregnancy have what are called "false labor pains." These have been attributed to rheumatism of the womb, to local uterine contractions, to contractions of the abdominal muscles, and to intestinal irritation. The last is probably the most frequent cause. False are distinguished from true pains by their not having been preceded by the premonitory symptoms of labor; by their situation, for they are not felt in the back, and from it extending in front, but in the abdomen, sometimes in one, and again in another part of it; by their being irregular in recurrence, not increasing in severity, and not causing any change in the os uteri. On the other hand, labor has begun when general contractions of the womb and progressive dilatation of its mouth occur.

The Effects of Labor upon the Mother. Parturition has an influence upon various functions of the maternal organism. The desire for food is lessened or lost; it is not unusual for nausea and vomiting to occur, especially toward the end of the first stage, and these are thought to facilitate dilatation of the mouth of the womb, a common belief being that sick labors are easy labors. But while this gastric disturbance is regarded as a good omen in the first stage, a very different character belongs to the vomiting which may occur in the second stage, with cessation of labor activity, and with exhaustion of the patient; the symptom is then dangerous, and immediate delivery is required. The pulse increases in frequency during a uterine contraction, lessening at its close; as this contraction drives much of the blood from the uterus into the general circulation, arterial tension is greater. Increased arterial tension and nervous irritation cause a greater secretion of urine; at first this fluid has a less specific gravity than normal, but afterward the

quantity of salts is greater. A slight shivering is observed in some patients at the beginning of each contraction. The respirations, less frequent during a pain, are more frequent during an interval; the temperature of the body, as well as that of the uterus, is slightly increased.

In the second stage the face is usually red and swelled, and it, and also the body and limbs, are bathed with perspiration. Patients in the absence of pains frequently are drowsy and disposed to sleep, this condition resulting in part from fatigue and in part from cerebral congestion. In labor some women are irritable, restless, and lose all self-control; but the majority pass through the terrible ordeal with patience and resignation, if not always with hope. A woman loses in labor one-ninth of her weight; the amount of loss is somewhat less in the primiparous than in the parous; the loss is of course chiefly due to the removal of the ovum, but the increased quantity of urine secreted, the perspiration, and the blood discharged with the placenta, contribute to it.

THE EFFECTS OF LABOR UPON THE FŒTUS. Uterine contractions cause temporary modifications in the fœtal circulation;[1] at the beginning of a contraction there is a slight acceleration in the pulsations of the fœtal heart, then these become slower when the contraction is strong; and, finally, when the tension of the uterus lessens, the double pulsations increase in order to resume their ordinary rhythm. The slowing of the fœtal heart during a contraction of the uterus is probably due to slight asphyxia from partial interruption of the placental circulation; it has also been attributed to greater intra-cardiac pressure, and to compression of the head. Pressure upon the fœtus may cause evacuation of the bladder or of the rectum; discharge of the meconium is common in presentation of the breech. If the placental circulation be interrupted, and hence the fœtus threatened with asphyxia, instinctive efforts to respire by the lungs are made. When the child is still unborn, if air enter its respiratory organs, it may cry, and to this cry the name of vagitus intra-uterinus has been given. The fact has been attested by reputable observers, but of course is exceedingly rare.

DURATION OF LABOR. This varies with race, climate, place and manner of living, heredity, age, organization, physical conformation, and whether first or subsequent labor, and with the sex, presentation, and position of the child. Labor is said to be shorter in warm than in cold climates, in savage than in civilized races, in women in the country, accustomed to plain food, out-door exercise, and regular hours of rest, than in those leading opposite lives in the city. In primiparæ labor is longer than in multiparæ; it is longer also in face or breech than in vertex presentations, in occipito-posterior than in occipito anterior positions, with male than with female children.

In primiparæ the usual period of labor is, according to Depaul, fifteen to twenty hours, but, according to Tarnier, twelve to fifteen hours; in multiparæ six to eight hours. Hecker and Ahlfeld state that the average duration of labor in primiparæ, thirty years old and more, is twenty-one to twenty-seven hours; Dieterlen's study of labor in 2369 primiparæ, the delivery being natural, shows that up to thirty-five years the

[1] Depaul.

duration varies but little, and is fifteen to sixteen hours, but that from thirty-five it rapidly increases, so that in primiparæ above forty-one years it is thirty-three hours. The average of all labors is, according to Naegele, twelve to fifteen hours. The second stage of labor is generally one-third that of the first. The majority of labors begin between 9 and 12 P.M. and end between 9 P.M. and 9 A.M.

PLASTIC PHENOMENA OF LABOR IN VERTEX PRESENTATIONS. By these phenomena are meant, not only, as previously stated, the changes in the form of the cranium caused by labor, but also the production of the caput succedaneum. The head delivered in an occipito-anterior position presents a cylindrical form; the occipito-frontal and occipito-mental diameters are lessened, but the maximum diameter is increased; the suboccipito-bregmatic, the bitemporal, and the biparietal diameters are lessened. According to Dohrn,[1] there is an asymmetry of the two lateral halves of the cranium, marked by the prominence of one of the parietal bones, and by the flattening of the other, which is sometimes pushed farther in front, sometimes farther back than the one on the opposite side, so that the parietal protuberances are not equidistant from the occipital protuberance. In occipito-sacral delivery the head has the appearance of being drawn out vertically from below above; the vertex makes a conical projection, so that the head has the form of a sugar-loaf. The forehead and the anterior part of the parietal bone are almost upon the same vertical plane; the occiput is flattened and pushed in front.

CAPUT SUCCEDANEUM. This is the name given to a tumor composed of a sero-sanguineous infiltration of the connective tissue, situated upon the presenting part of the fœtus. The swelling occurs upon that part which is not subjected to pressure. "In the course of labor,[2] after the evacuation of the liquor amnii, the child is during pains subjected to strong pressure from the parturient forces, and equally strong counter-pressure from the resisting maternal passages. Every part of the child is subjected to these forces, except that adjacent to the as yet undilated passage through which the child is being urged."

The caput succedaneum does not fluctuate, pits on pressure, and is violet-colored. The longer and more difficult the labor, the larger this swelling. By some it has been improperly termed cephalhæmatoma; Bouchut describes it under the name of supra-periosteal cephalhæmatoma, or pseudo-cephalhæmatoma. Cephalhæmatoma is an effusion of blood between the periosteum and the bone; it is more frequently found upon the right than upon the left parietal bone, in some cases upon both, in others upon the occipital, upon the temporal, or upon the frontal. The affection rarely occurs. Bouchut[3] describes it as an indolent, distinctly circumscribed, soft, and fluctuating tumor, and attended by no discoloration of the skin; it may be as large as a pullet's egg. The severity or great length of the labor has no influence upon its production. There may be felt in many cases a bony circle at its base separating it from adjacent parts.

In left occipito-anterior position the caput succedaneum is upon the posterior and superior angle of the right parietal bone. In left

[1] Tarnier. [2] Duncan. [3] Op. cit.

occipito-posterior position it occupies the superior and anterior angle of the right parietal bone. In right occipito-anterior position the caput succedaneum is at the posterior and superior angle of the left parietal; and in right occipito-posterior position, at the superior and anterior angle of the same bone. If in consequence of slight resistance the labor be very rapid, no caput succedanum may be formed.

After the head has descended to the pelvic floor, and anterior rotation occurred, if delivery be delayed, a secondary caput succedaneum will be formed; but this will be always in the median line, and not limited to one of the parietal bones.

While early rupture of the membranes, the labor being protracted, causes greater size of the caput succedaneum, yet it may begin before this rupture. In such exceptional cases Matthews Duncan suggests "the liquor amnii must be in such minute quantity as to have no hydrodynamical properties" But it seems a clearer explanation to say the event occurs because of the minute quantity of this fluid in advance of the head, for the statement quoted is at least ambiguous.

The caput succedaneum is not found if the fœtus is dead, and Runge suggests that this may be an important mark in doubtful cases as to the life of the child.

This effusion in the connective tissue disappears in a day or two; while a subperiosteal hemorrhage, or true cephalhæmatoma, will last from ten to sixty days.

CHAPTER XI.

THE MECHANICAL PHENOMENA OF LABOR.

THE mechanical phenomena of labor are the passive movements given the fœtus in its expulsion. These phenomena are included under the general term mechanism of labor. The efficient cause of labor is the force of uterine and of abdominal contractions; the final cause, that is, the design, is birth; but the former in accomplishing this end must act by material and formal causes. Now, the material cause is the fœtus and the birth-canal, and the formal cause includes the adaptations of the former to the latter, adaptations by which its transmission is rendered possible. Certain diameters of the fœtal head are greater than any of the pelvic diameters, and hence if the former be brought into relation with the latter, the further movement of the fœtus is impossible. The birth-canal presents an axis of emergence almost perpendicular to the axis of entrance, and therefore the fœtus going into that canal in one direction must take another and very different direction in order to pass out. The longest diameter of the pelvic inlet is an oblique diameter, while that of the outlet is antero-posterior; hence a diameter of the fœtal head, which requires the space given by the former for its transmission, will, when it descends to the outlet, need to be placed in relation with the latter in order that it can pass out. One word explains these various passive movements of the fœtus in birth, and that is, *accommodation;* during the whole process of delivery there must be adaptations and correspondences between the passenger and the passage through which it is transmitted.

It will be seen in the study of the mechanism of labor that there is a unity of character in all labors, no matter what the presentation or position of the fœtus; provided the labor be natural, occurring at term, and the fœtus be living, there is but one mechanism.[1]

Before studying the mechanical phenomena of parturition a few words must be said in regard to presentation and position. As has been before stated, presentation is that part of the fœtus which is in relation with the pelvic inlet—that which presents, offers to the examining finger at the mouth of the womb, or that part through which the pelvic axis passes—and our first inquiry is as to the number of presentations. Baudelocque described twenty-three, making for these ninety-four positions; but it is fortuuate for medical students that authorities do not follow him. Madame Lachapelle was the first to show that the fœtus presented by the cephalic, or the pelvic extremity, or by the trunk. But these presentations, which are apparently three, really include five. The fœtal ovoid usually corresponds with the uterine ovoid; that is, the fœtus occupies a longitudinal situation in the womb,

[1] Pajot.

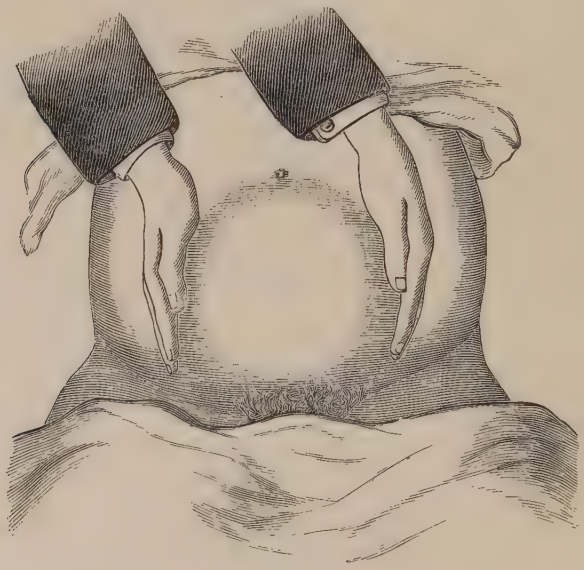
and hence one or the other end of this ovoid, generally the head, is at the pelvic inlet. If the head be inclined forward with reference to the trunk, that is, flexion be present, and this is the case generally, the vertex—summit or top of the head—presents, and hence the presentation is cranial. On the other hand, if deflexion—bending back of the head, extension—has occurred, the face presents, and the presentation is called by this name or facial. The pelvis of the fœtus may be in the lower segment of the womb, and then the presentation is pelvic. This presentation is not changed by any change of position of the lower limbs; the pelvic wedge may be complete or decomposed—a knee or foot, both knees or both feet,[1] may come first, but no matter what the changes of position of these parts, none of the mechanical phenomena of labor are needed to adapt them to the birth-canal, for they are small and the space offered by the maternal pelvis is relatively large; and on the other hand such changes, such mechanism, are required for the expulsion of the breech. Those parts, therefore, are included under pelvic presentation which may be defined as embracing all that part of the fœtus below a horizontal line passing from one to the other iliac crest. The fœtus lying transversely, or nearly so, may present some part of the body at the inlet; but the tendency in all cases is for one or the other shoulder to descend first, so that presentation of the body becomes that of the right or that of the left shoulder. We thus have five presentations, cranial, or vertex, facial, pelvic, right and left shoulder. The relations which the presenting part of the fœtus has to certain fixed points of the inlet give the position. For most obstetricians these points are the sacro-iliac joints and the ilio-pectineal eminences; they are the terminations of the oblique diameters of the inlet. It follows, therefore, as some selected point of reference for each presentation is in relation with one of these four points of the mother's pelvis, sometimes called the cardinal points of Capuron, the position is determined, and that there are four positions. The latter part of this statement, however, only applies to the first three presentations; each shoulder presentation has only two positions, as will be explained hereafter.

It is important that the student should have clearly fixed in his mind the essential difference between presentation and position, never confounding them, never using one as a synonym for the other. Presentation means an object, but position is a relation; the former is part of the fœtus, the latter a temporary relation of that part to the mother's pelvis; position is an accident, the property of a presentation, belonging to it, while the reverse can never be true. Further, it is important not to confound position as belonging to presentation with position as belonging to the fœtus. The fœtus is said to be in a longitudinal or a

[1] Those born with the feet first were called *Agrippas*. Roederer, *Elementa Artis Obstetriciæ*, observes: Quando fœtus pedes primi ad orificium decidunt, *partus agripparum* oritur. In Pliny's Natural History, Book Seventh, the following passage is found: In pedes procedere nascentem, contra naturam est: quo argumento eos appellavere Agrippas, ut ægre partos. This explanation of the origin of the term has been accepted in the New Sydenham Society's Lexicon. But a more probable origin is given by Kraus, *Kritisch-etymologisches medicinisches Lexikon:* agrippa is from ἄγριος ἵππος, feminine ἄγρια ἵππα, for the nomadic tribes being more familiar with parturition as it occurred in mares, gave this name to children born with the feet first. According to Schröder, there was a superstition that those born thus would be injurious to themselves and to society, and in confirmation of the belief the examples of Agrippa, Nero, Richard III., and Louis XV., were cited.

transverse position in the uterine cavity; but this use of the word is very different from that in connection with presentation. The four positions belonging to each of the three presentations—cranial, facial, and pelvic—are generally designated first, second, third, and fourth. Their relative frequency is not settled—at least all authorities do not agree—and, therefore, the fitness of the term is questionable; but as the mechanism of labor presents some slight differences according as the point of reference of the presenting part is in the right or left side of the mother's pelvis, and as to whether it is anterior or posterior, these positions will be distinguished as right and left anterior, and right and left posterior. In vertex or cranial presentation, for illustration, this point of reference is the occiput, so that the four positions for this presentation are left occipito-anterior, left occipito-posterior, right occipito-anterior, and right occipito-posterior.

FIG. 108.



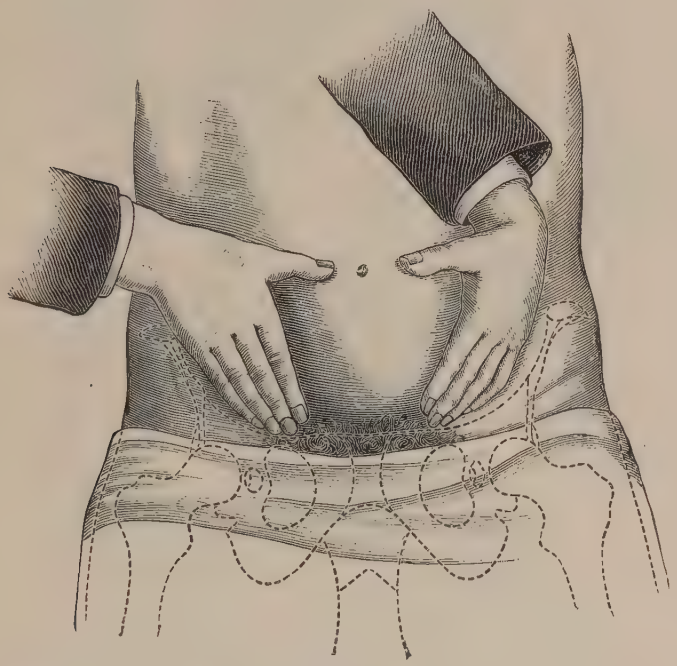
PALPATION OF UTERUS, THE HANDS AT ITS SIDES.

DIAGNOSIS. The diagnosis of presentation and position is made by auscultation, abdominal palpation, and vaginal touch. The first two are most useful in pregnancy, the last in labor; the former cannot be made during uterine contraction, and the third, if then made, the membranes being unruptured, must be done with great care to avoid their rupture. Nevertheless, it is held that the practitioner who makes himself expert in obstetric palpation and auscultation, can reduce to a minimum vaginal examinations, thus lessening the liability to septic infection.

VERTEX PRESENTATION—DIAGNOSIS. The vertex presents, according to Naegele, in 93 to 95 per cent., according to Spiegelberg in 97 per cent., of all cases; the causes of this great frequency have been stated.

In making a diagnosis by external examination the practitioner should first ascertain that the fœtus is not placed transversely, but occupies a longitudinal situation in the womb—the fœtal thus corresponding with the uterine ovoid. He learns this by observing the general form of the abdomen, and by his being able in palpation to circumscribe with his hand the fundus of the uterus in its normal position. The next step is to find which end of the fœtal ovoid is in the lower segment of the uterus. In doing this the obstetrician places his hands extended and flat upon the lower part of the sides of the abdomen, pressing them somewhat downward at the ulnar border within the iliac fossæ; then the hands, still pressed downward and moved toward each other, will in-

Fig. 109.

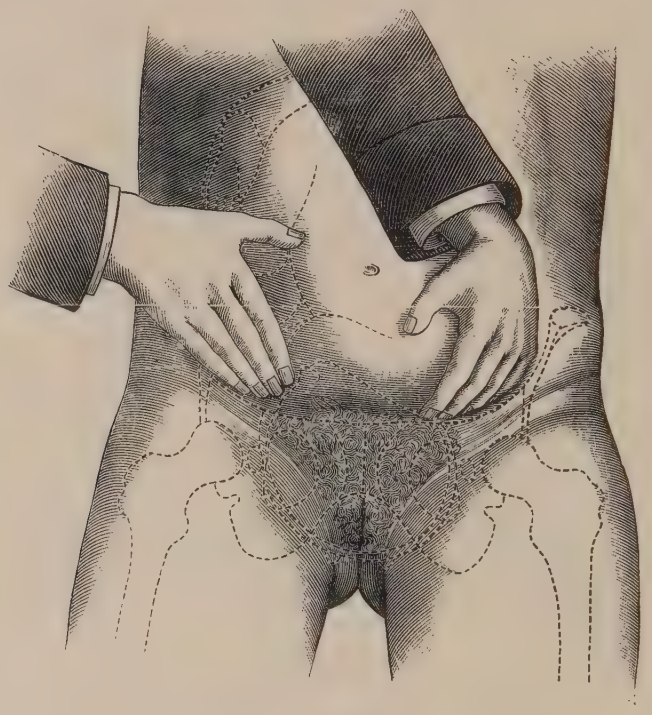


Ascertaining the Presence of the Fœtal Head in Lower Part of Uterus.

clude the fœtal head if it be in the lower part of the uterus, and if it has not entered the pelvic cavity. Instead of at first placing the hands upon the sides of the uterus, they may be in contact with each other directly in the median line of the uterine globe just above the pubes, then gradually separated, pressing the ulnar edge of each downward upon the abdominal wall in this movement until they pass deeper, when they reach the borders of the uterus, and the lower portion of this organ is then included between them. This manipulation, it should be observed, is of chief value in the diagnosis during pregnancy. A single hand may often be successfully used in abdominal palpation in order to determine that the fœtal head is in the lower part of the uterus. The distinguish-

ing marks of the fœtal head in palpation are, its uniformity of shape, roundness, hardness, and mobility; if the head be in the pelvic cavity, the characteristic last stated fails. The fact that the presenting part is in the pelvic cavity in the latter part of pregnancy, or early in labor, is a strong proof that the presentation is neither the pelvis nor the face, but the vertex. Further, in this situation one hand can be carried deeper into the pelvis, while the hand on the other side of the pelvis meets with resistance (Fig. 110); the occiput therefore is upon the one

Fig. 110.



Palpation when the Fœtal Head is in the Pelvis.

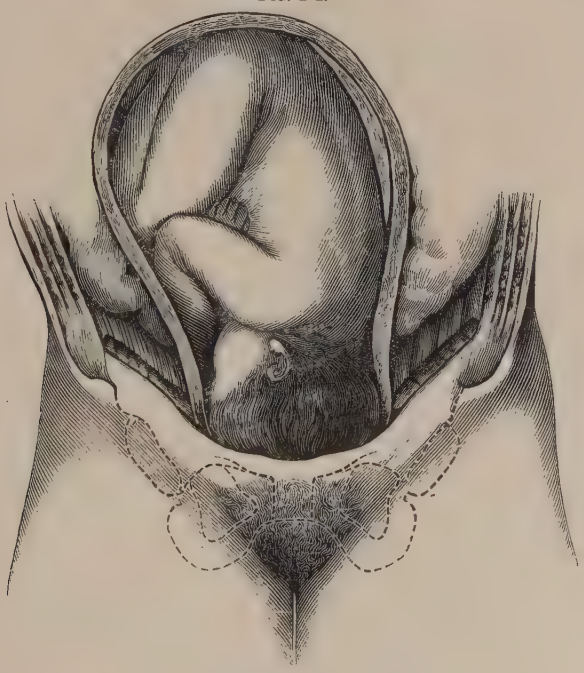
side, the forehead upon the other, and the former being more deeply situated allows the descent of the hand, while the latter prevents such penetration. Further, when the occiput is found the position of the back is known, for it must be upon the same side as the occiput. The practitioner may then verify his diagnosis by exploring the fundus of the uterus in which the pelvis of the fœtus will be felt. This part of the child is recognized as a large, firm, and somewhat round body, but it lacks the uniform shape, the solidity, and the mobility of the head; moreover, there will be found near it small movable bodies, parts of one or both lower limbs. The means by which a vertex is distinguished from a face presentation will be given when the latter is considered.

Auscultation. If the pulsations of the fœtal heart are heard most

distinctly below the transverse line (see Fig. 105), the head is most probably in the lower part of the uterus, and when heard to the left of the median line the occiput is in the left side of the mother's pelvis, but if upon the right, the occiput is in the right side.

Internal Examination. The method of vaginal examination has been given on pages 189–192. Again, let the practitioner be cautioned against the danger of rupturing the membranes by pressure upon the bag during a uterine contraction; he should, therefore, usually defer exploration of the presenting part until the contraction ceases. If the head has descended into the pelvic cavity, the finger touches a round, hard, projecting body, and the margin of the mouth of the womb. If the head be high up, only a small portion of the cranial vault is accessible to the finger, but a large portion may be reached if the other hand is used to press firmly upon the hypogastrium so as to force the head further into the pelvis. When the os is dilated the bones may be plainly felt through the fœtal membranes, and during a contraction the wrinkling of the scalp and the overriding of the bones. If labor has been in progress some time, a large soft mass, the *caput succedaneum*, may conceal the cranial bones; but by pressing firmly upon this mass it is possible the finger may detect beneath it a bony surface, or else the finger should be passed within the os so as to touch parts above the swelling.

Fig. 111.



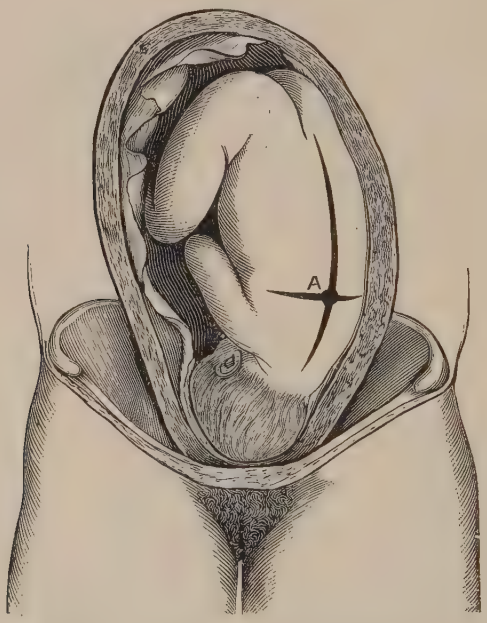
Left Occipito-anterior Position.

Position. Having ascertained that the presentation is cranial, the position is next to be ascertained. The occiput being the point of ref-

erence, in this presentation, the question is as to its relation to some one of the cardinal points of the inlet. If it is directed toward the left ilio-pectineal eminence, the position is left occipito-anterior; if to the right, right occipito-anterior; if to the left sacro-iliac joint, left occipito-posterior, but if to the right, right occipito-posterior.

The same means are available for the diagnosis of position as for the diagnosis of presentation, viz., abdominal palpation, auscultation, and vaginal touch. The application of these means will be considered with each of the four positions given, following the diagnosis with a description of the mechanism of labor.

Fig. 112.



Place of Greatest Intensity of Fœtal Heart-sounds in Left Occipito-anterior Position.

First. Left Occipito-anterior Positions (Figs. 111, 112). Ascertaining that the back of the child is upon the left side of the mother's abdomen, we know that the occiput is anterior or posterior to the left side of the pelvis; and if the resistance given by the back lessens as the hand is carried farther to the left side, the occiput, of course, which is in the line of greatest resistance, points to the ilio-pectineal eminence —that is, the position is left occipito-anterior.

Upon auscultation the maximum of intensity of the fœtal heart-sounds is found about the middle of a line passing from the left ilio-pectineal eminence to the umbilicus; some, however, have the line start from the left anterior spinous process of the ilium.

By vaginal touch the sagittal suture is usually felt crossing the pelvic area obliquely, though it may be transverse, and a little nearer the promonotory than it is to the pubic joint. Having found the suture, the

finger follows it either to the right or to the left until the anterior or posterior fontanelle is felt. The anterior fontanelle is upon the right side of the mother's pelvis, and necessarily the occiput is upon the opposite side. If the finger follows the course of the sagittal suture to the posterior fontanelle, the place rather than the presence of the latter is recognized by its being at the apex of a depressed triangle, two sides of which are made by the margins of the parietal bones overriding the occipital bone, these sides corresponding with the bifurcation of the sagittal suture. The occiput is at or near the left ilio-pectineal eminence. This position, left occipito-anterior, has been generally called the first, and it is the first in frequency, occurring in about seventy per cent.

FIG. 113.

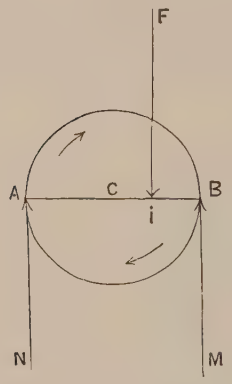
FIRST CRANIAL POSITION. OCCIPUT AT THE LEFT ILIO-PECTINEAL EMINENCE, FOREHEAD AT THE RIGHT SACRO-ILIAC JOINT.

MECHANISM OF LABOR. In studying this mechanism it is convenient to divide it into stages, or times; but it is to be remembered that this division is arbitrary, for some of these stages may occur contemporaneously, or some may be absent, but in such cases the necessity for them does not exist, the factors causing them are wanting. These different stages are, in presentation of the vertex, first, flexion; second, descent, also called engagement, or progression; third, rotation; fourth, extension; fifth, external rotation of the head with internal rotation of the body; and, sixth, delivery of the body. Each of these mechanical phenomena is to be studied as to its causes, its effects, and its diagnosis.

FLEXION. This is bending the chin toward the chest so that it rests on it when flexion is complete; it is essentially rotation of the head upon a transverse axis. In considering the causes of flexion the natural position of the head must be regarded as predisposing to this purely passive movement, for it is already somewhat flexed, and the flexion occurring in labor is simply an increase in this state. It has been taught by some that the articulation of the head with the vertebral column being nearer the occiput than it is to the forehead, the force passing through that column acts with greater power upon the occiput, causing it to descend while the forehead rises, and thus flexion is increased. But as long as the fœtus is inclosed in the membranes, direct pressure upon it does not occur; uterine contractions compress the ovum at all points equally, except at the lower segment of the uterus and the os

uteri; these are dilated by the pressure, and the force is transmitted to the fœtus through the intervening liquor amnii. Even after the rupture of the membranes the fœtal head may so effectually plug the cervico-uterine canal that only a small quantity of amnial liquor escapes, and therefore direct pressure of the fundus of the uterus upon the upper

Fig. 114.



Equal Resisting Forces acting through Levers of Unequal Length.

Fig. 115.

Illustrating the Different Lengths of the Frontal Arm, F B, and the Occipital Arm, B O, of the Lever made by the Fœtal Head.

portion of the fœtal ovoid falls. It therefore follows that the direction of the uterine force cannot be determined by pressure of the fundus immediately upon the fœtus in the first stage of labor, or, indeed, subsequently before the free discharge of the amnial liquor.

The most generally received explanation of this phenomenon of labor is that it results from the unequal lengths of the two arms of a lever represented by the head, for that part of the head in front of the vertebral articulation presents a greater surface than that behind this articulation; in other words, the anterior arm of the lever is longer than the posterior—that is, the distance from the occipital foramen to the forehead is greater than from the occipital foramen to the occiput. Hence equal resistances applied to these two arms necessarily cause the anterior or longer arm to rise, the posterior or shorter to descend.

In the subjoined diagram (Fig. 114), taken from Hubert, let the line F i represent the active force; N A and M B equal resistances; the short arm of the lever, A B, that is, B i, must descend, for the resistance, N A, is the more powerful, because acting through the long arm, A i.

Fig. 115, taken from Ribemont, shows the much greater length of the anterior than of the posterior arm of the lever represented by the head; F B is the frontal, and B O the occipital arm; the sum of resistance-

pressure to which the former is subjected must much exceed that which opposes the descent of the latter.

Another principle in mechanics has been brought forward by Hubert as contributing to flexion. If a propulsive force be exercised centrally upon a mobile, and there be resisting forces not directly opposite each other, but at different levels, rotation of the mobile occurs; thus, flexion of the head, which, as has been before stated, is simply rotation of the head upon a transverse axis, is frequently completed when the os uteri is almost entirely dilated so that the occiput has escaped, and the resistance of the os acts upon the forehead and the face, causing flexion.

According to Lahs,[1] the entire expulsive force of the uterus acts upon the fœtal head in a line perpendicular to the surface of what he terms "the girdle of contact"—that is, the part of the birth-canal for the time resisting the advance of the head. "The head is a wedge, whose surfaces are found through the tangents made on those points of the head's surface directly in relation with the girdle of contact." That part of the head whose tangent makes the smaller angle with the perpendicular line of expulsion must descend first. This smaller angle is made at the occiput, and therefore this descends and flexion results.

Whatever theory of flexion may be adopted, the movement itself is essentially one of accommodation, of adaptation of the fœtal head to its passage through the birth-canal. The head entered the inlet with the occiput at the left ilio-pectineal eminence, and the forehead at the right sacro-iliac joint, that is, the occipito-frontal diameter was in relation with the right oblique of the inlet, and the bi-parietal with the left oblique; hence a circumference of the fœtal head whose diameter is the occipito-frontal is in relation with the circumference of the inlet. The long diameter is not perpendicular, but oblique to the plane of the inlet; besides this obliquity it was asserted by Naegele that the head entered inclined on the anterior parietal bone, so that the right parietal protuberance was somewhat lower than the left, and this inclination was known as Naegele's obliquity,[2] but most obstetricians reject it; at least its consideration may well be omitted in the study of the mechanism of normal labor. The effect of flexion is not only to bring the long diameter of the fœtal head more or less completely in correspondence with the axis of the inlet, but to present a less circumference of the head to the circumference of the inlet, for as the chin comes to the sternum, not the occipito-frontal diameter, but a shorter one, the suboccipito-bregmatic, is in relation with the left oblique of the inlet. Remembering that flexion is a movement of accommodation, it occurs when and where such accommodation is necessary. It may, therefore, take place at the inlet, in the lower portion or at the mouth of the uterus, or at the perineal floor, or, finally, it may not occur because the small size of the fœtus, or the great size of the pelvis, the slight resistance of the os uteri, or of the pelvic floor renders it unnecessary.

Flexion not only substitutes a less fœtal head plane, but, according to Pajot,[3] prior to its occurrence there is a great loss of force from its transmission through a flexible, vacillating rod, to which he compares the fœtus, the mobility existing especially at the articulation of the head

[1] Die Theorie der Geburt.
[2] The obliquity of Solayres refers to the head entering the pelvic inlet in one of its oblique diameters, and Roederer's to the complete flexion of the head on the chest.
[3] Dictionnaire Encyclopédique des Sciences Médicales.

with the trunk; but when the head is firmly pressed upon the thorax it is found favorably disposed to participate in the impulsion impressed upon the general mass of the fœtus. Further, flexion facilitates moulding of the head so that it is adapted to the birth-canal. The diagnosis of flexion is made by the recognition of the relative position of the fontanelles; at the beginning of labor they are almost upon the same plane, the anterior a little higher than the posterior; as flexion occurs, the former recedes with the ascent of the forehead, but the latter descends with the descent of the occiput, and when the anterior is very high, and consequently the posterior very low, flexion is complete, but if the two are equally accessible, it has not occurred.

Descent. The uterine, reinforced by abdominal, contractions now compel the head to descend into the pelvic cavity; the axis of the uterus corresponding with that of the upper part of this cavity there is no loss of force, and hence if there be the proper relation between the fœtal head and the canal, the latter presenting only its usual resistance, and the driving force normal, there is no delay in the descent of the head. The head planes are parallel with the pelvic planes during the first part of the descent, and then in consequence of the greater resistance of the posterior than of the anterior pelvic wall, this *synclitism*—that is, the parallelism between the planes of the child's head and the transverse planes of the mother's pelvis—ceases, though Dr. Hodge and some other obstetricians taught that it continued during the entire descent.

A movement called *levelling* is described by some as occurring when the head has descended so that the occiput is at the lower margin of the ischio-pubic foramen, and the bregma is at the second bone of the sacrum; by this movement, essentially a lessening of flexion, the anterior fontanelle becomes more accessible, and the occipito-frontal diameter is in relation with the right oblique of the pelvic canal. This phenomenon is not constant, does not contribute when present to the progress of labor, and therefore may be dismissed from further consideration.

The progress of the second stage of labor is ascertained by measuring with the finger the distance of the head from the vulval opening. This measurement is most conveniently made by using the thumb as an index to the measuring-rod, the finger. Two errors are to be guarded against: First, mistaking a caput succedaneum for advance of the head; and, second, the head may descend still inclosed in the uterus, whose lower segment may be so thinned that without great care the examiner believes he directly touches the head, and may conclude that the labor is much further advanced than it really is.

Rotation. This is a movement by which the occiput turns in front, the entire trunk participating in the rotation. The expulsive power driving the head down, the occiput is forced to escape, but only anteriorly is there a gap in the pelvic wall, and to this gap the ischio-pubic ramus —bevelled, flaring—invites; the occiput descends with a pain, boring, feeling its way, receding in the interval between pains, until finally driven by a vigorous pain it passes the bony margin at the latero-anterior part of the pelvis, and there is no subsequent recession, but it sweeps forward toward the centre of the vulval opening, and the sub-occipital region comes under the pubic symphysis. As observed by Dr. Ritchie,[1] in

[1] Medical Times and Gazette, 1865.

some cases the head escapes all pivot movement in the pelvis, but comes down obliquely upon the perineum, and suddenly wheels round when it is on the point of escaping from the vulva, the rotation resulting from the shape of the perineum which, attached on either side, yields most in the median line, thus forming a gutter in which the head is best accommodated, lying not obliquely but antero-posteriorly. When rotation of the head occurs in the pelvic cavity, while the occiput comes in front, there is a reverse movement of the sinciput which turns into the sacral cavity.

Obstetric authorities have devoted much attention to the study of the causes of rotation, and have greatly differed as to them. Baudelocque referred this phenomenon to the inclined planes of the pelvis, the anterior determining rotation into the pubic arch, the posterior rotation into the sacral cavity. This view probably has had more adherents than any presented since; some have modified it by changing the position of the arbitrary lines, separating the anterior from the posterior planes, but still essentially their teaching has been that of Baudelocque; this was true especially of the teaching of Hodge. But the accepted explanation of the cause of rotation, while satisfactory so far as anterior positions of the occiput are concerned, failed as to posterior positions, for in these, too, as first proved by Naegele, the occiput in most cases rotates anteriorly. Perineal resistance, according to some, is the cause of anterior rotation; but, as observed by Charpentier, this cannot be the sole cause, or the movement ought never to fail in primiparæ, for in them the perineum is remarkably resistant. The unequal lengths of the two arms of the head lever is, according to others, the cause, for the occipital arm being the shorter the occiput moves in the direction of least resistance.

The law of mechanics, which Hubert has applied to the explanation of flexion, has its application here also. When a mobile is subjected to resisting forces, which are not directly opposite, they tend to impress upon it a movement of rotation. While some assert that this explanation holds only for the rotation which occurs in anterior positions, it may be shown in the discussion of the mechanism of labor in posterior positions that the anterior rotation which then occurs can also be thus explained. Pajot, rejecting all geometrical explanations, finds the just idea of the causes of rotation in the immutable principle of mechanics which has been formulated in what is known as his law (previously stated): "The indispensable condition for the execution of this law is that the power, the volume of the content, and the capacity of the container must be proportional." If the fœtus be too large, insurmountable obstacles are presented to its rotation; if it be too small, there is no invitation to turn, and when the fœtus and the passage are in due proportion, turning may fail for want of sufficient expulsive force. The results of rotation are that the suboccipito-bregmatic diameter, which corresponded with the right oblique of the mother's pelvis, is now in relation with the antero-posterior of the outlet, and the biparietal with the transverse, and the shoulders—as the body participated in the rotation—descended in the pelvis with the bisacromial diameter in relation with its transverse diameter. Rotation is known to have taken place by the position in which the occiput is found—that is, directly in front; in some cases the

movement may be recognized during its occurrence by a finger placed upon the occiput.

Extension. The third of the mechanical phenomena of labor is a movement of the head directly the reverse of the first; whereas the head then rotated forward on its transverse axis, so that the chin came to rest on the sternum—it now rotates backward, and the chin recedes from the sternum, that is, deflexion or extension occurs. In this movement the nape of the neck presses the subpubic ligament, the shoulders are transverse, and close behind the pubic arch, so that the occiput can advance no further in a direct line; meanwhile expulsive action continuing is met by the resistance of the perineum, and the resultant diagonal force is in the axis of the prolonged birth-canal; the expulsive force cannot act directly upon the occiput, but only upon the long arm of the head lever, thus forcing the chin to descend; according to Pajot, the occipito-mental diameter represents a lever of the third order, the fulcrum being at the pubic arch, the resistance at the pelvic floor, and the power between the two, that is, at the occipital foramen. But extension or rotation backward of the fœtal head may also be explained as the result of a driving force met by two resisting forces acting upon the fœtal head at different planes, or two unequal forces, even if acting in the same plane. We have first the driving force of uterine and abdominal contractions; the perineum resists, and there is also resistance at the pubic arch, but the former resistance being less than the latter, rotation results—the head is rolled out of the vulval opening, the bregma, the forehead, and the face appearing successively from behind the perineum, the occiput continuing to move in a curve over the pubic symphysis, the successive radii of this curve being the several suboccipital diameters.[1] The longest of these diameters is the suboccipito-frontal, and the vulval opening is of course in greatest danger of being torn during the passage of the head circumference corresponding with this diameter. The progress of this stage of labor is known by the emergence of a greater part of the fœtal head at each expulsive effort, and its completion by the dropping down of the head in front of the anus, and by the retraction of the perineum.

External Rotation of the Head with Internal Rotation of the Body. In some cases just after the head drops down—face below, occiput above, there is a change of the head to an oblique position: this movement is called *restitution*, and it takes place when in internal rotation the body did not follow the head in this movement, but a twist in the neck occurred, and now the head is *restored* to its normal position with reference to the trunk. Restitution is oftener seen in occipito-posterior than in occipito-anterior positions, but even in the former it is not frequent, for with perfect flexion the fœtus is so compacted together that head and trunk make one mass, and move together. In most cases no such movement as restitution is recognized, but the

[1] This hitherto generally received explanation of the expulsion of the fœtal head has recently been controverted by Berry Hart, who, denying extension, claims that progression, or translation of the head, occurs, occiput and sinciput simultaneously advancing. He attributes that which he calls the erroneous idea of extension to the fact that "the attendant, while the patient lay on her left side, watched the passage of the fœtal head from behind, saw more of the anterior portion of the head appear, and accounted for it by extension." Hart's opinion will be referred to on a future page.

head remains motionless after dropping down with the end of the fourth stage of labor, until a new expulsive effort occurs, and then it moves through the fourth of a circle so that the occiput points to the mother's left thigh, and the face to her right thigh. A simple law may be given in this connection—the occiput always points to that thigh corresponding to the side of the pelvis in which it was before the delivery of the head, and thus if the occiput was in the left side of the pelvis, no matter whether posterior or anterior, it will point to the left thigh. The external rotation of the head indicates the internal rotation of the shoulders; they descended into the pelvis, the bisacromial diameter in relation with the left oblique of the inlet; the body rotating with the head the bisacromial became transverse, but as delivery in this position is impossible, body rotation, which is indicated by external rotation of the head, takes place, so that the right shoulder is behind the pubic joint and the left is in the sacral cavity.

Expulsion of the Body. Expulsive efforts continuing, the pubic shoulder passes out first—it has the shorter distance to traverse, and it represents the occiput which was delivered first—and the superior part of the trunk pivots upon the arm just below the shoulder, while the sacral shoulder sweeps the sacral curve and follows the course of the distended perineum, the perineal pressure and the direction of the canal

Fig. 116.

External Rotation of Head in First Position.

causing incurvation of the body upon its lateral plane; the sacral shoulder is finally delivered, and the arm quickly follows, and then the pubic arm passes out, and the lateral curvature of the body is at an end. Just as the nape of the neck was fixed at the subpubic ligament in delivery of the head, so is the upper part of the pubic arm situated in delivery of the superior portion of the trunk; delivery of the head was effected through extension, but that of the shoulders by flexion, the lateral incurvation of the body is simply the analogue of extension of the head.

Authorities differ as to which shoulder is delivered first, and some end the controversy by asserting a simultaneous delivery. The illustration just presented shows that the upper shoulder has passed the pubic arch, while the under one

is still hidden by the perineum; although Dr. Hodge, from whose work the diagram is taken, taught that they escaped at the same time, the statement is contradicted by it. Cazeaux held that in primiparæ the delivery is as stated in the text, but not in the parous when the perineum has been torn. But this is a concession of the very point at issue, and we may say with Pajot that in the normal mechanism of labor the pubic shoulder is first delivered.

The expulsion of the rest of the body rapidly follows that of the shoulders, the trunk making somewhat of a spiral movement; if the hips are very large, there may be delay, and the same mechanism occurs as in the delivery of the shoulders.

The Rotations. In the preceding description of the mechanism of labor the rotations that have been stated are two, but there is also a third of the mechanical phenomena of labor that is essentially a rotation, for flexion of the head is simply the turning of the head upon a transverse axis; so, too, the head rotates in its expulsion, only the rotation is directly the opposite of that which occurred in complete flexion.

Fritsch[1] describes five rotations. The first of these is the lateral turning of the head in entering the pelvis, so that the anterior parietal is lower than the posterior, the sagittal suture being nearer the promontory than it is to the anterior pelvic wall. This position, known as Naegele's obliquity, according to him, results from the projection of the promontory, and from there being no similar resistance at the anterior pelvic wall.

But this obliquity, while a constant feature in the flat pelvis, is by no means, according to most obstetricians, a frequent phenomenon in a normal pelvis, and therefore its consideration may be omitted.

Of the other rotations, the only one considered in this note is the anterior rotation of the occiput into the pubic arch. This rotation has given rise to much discussion, many explanations have been offered, and by no means the last word has been said. It is impossible to mention all the theories of its causes. Werth[2] explains that this movement occurs because the anterior pelvic wall and the region of the pubic arch offer no important resistance, while laterally and behind notable obstruction opposes. Fritsch refers to the frontal bone pressing against the anterior lateral part of one-half the pelvis, and there an oblique plane tends to cause a movement posteriorly; then the form of the horizontal pelvic plane is such that there are two angles presented, one anterior and acute, the other posterior and obtuse; the forehead must turn into the opening of the latter.

Some have attributed, either wholly or in chief part, the turning of the occiput forward to the action of the levatores ani; this was the teaching of my predecessor in Jefferson Medical College, the late Dr. Ellerslie Wallace, and it has also been held by some of the most eminent among German obstetric teachers.

It is not remarkable that the rotation of the head internally, like its rotation externally, has been by several authorities explained as resulting from a movement of the body; as external rotation of the head tells of internal rotation of the shoulders or trunk, so it is claimed that this results from a similar movement of the body. Many eminent obstetricians uphold this view; among these may be mentioned Litzmann, Kehrer, and Olshausen. The last has stated that in consequence of the increased flattening of the uterus by contractions the back of the child is pushed from a lateral to a front position, because of more room anteriorly, necessarily then the child's head is turned so that the sagittal suture is antero-posterior. Ahlfeld[3] criticises this view on two grounds: First, rotation of the head occurs in the first of twins when the uterus is not flattened, and, second, it occurs, too, in a head-last labor.

Ostermann, in a recent monograph, *Die Cardinallebewegung des Geburtsmechanismus*, regarding previous explanations as not completely satisfactory, endeavors to make good a new theory applicable to all cases. He starts with presenting the three factors to be considered, namely, the expulsive force, the canal and its

[1] Klink der Geburtshülflichen Operationen. 1894.
[2] Müller's Handbuch der Geburtshülfe. I. Band. 1888.
[3] Lehrbuch der Geburtshilfe. 1894.

form, and third, the fœtus and its form. The rotation which is being especially considered, he attributes to the uterine contractions which place the shoulders in a transverse position at the pelvic inlet.

The main factor in rotation depends chiefly upon the greater flexibility of the antero-posterior and the less lateral flexibility of the vertebral column.

Osterman concludes his paper by saying: "We have endeavored to show the influence of both factors, the simple flexion of the lower pole toward the opening of the canal, and the invariable preponderance of the antero-posterior flexibility of the vertebral column. It may seem that a more important influence is ascribed to the fœtus than is the actual fact. This appears to us to rest upon the natural conditions. Should we wish briefly to describe the transmission of the fœtus, we would say: The fœtus winds itself through the birth-canal throughout; but this expression must not be understood to suggest an active participation. In this strong and general statement the assertion that the anterior rotation of the small fontanelle is referred to the turning of the deepest part (Schroeder) seems unnecessary, at least it is not lost in a chaos of details. Admitting the previously considered factor, so we believe it may be applied for the explanation of all cases of rotation."

The anterior rotation of the occiput may occur, as many obstetricians have observed, before the head rests upon the pelvic floor, and therefore this cause, offered by many as explaining the mechanism of the movement, cannot be admitted a constant factor.

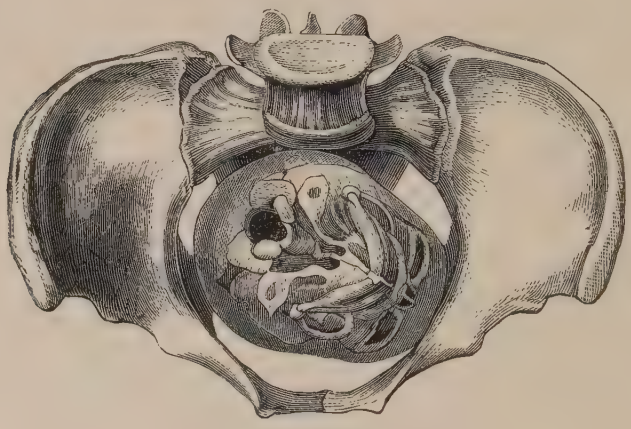
Right Occipito-anterior Position. In this position, which is the rarest of the four, the occiput is in the inlet, at the right ilio-pectineal eminence, and the forehead at the left sacro-iliac joint, the child's back is in the right and anterior portion of the uterus, and the limbs in the left and posterior portion. By abdominal palpation the head is found in the lower segment of the uterus, and the back in the situation mentioned; the hand passes more deeply in the pelvis upon the right side than upon the left. Upon auscultation the maximum of intensity of the fœtal heart-sounds is found, according to Depaul, at the middle of a line passing from the right ilio-pectineal eminence to the umbilicus (see Fig. 105; this maximum is found at *C*), but according to Ribemont upon the median line, sometimes, indeed, a little to the left of it. Digital examination confirms the diagnosis of a vertex presentation, and the sagittal suture is found to be in the left oblique diameter of the inlet, the occiput at the right ilio-pectineal eminence, and the forehead at the left sacro-iliac joint.

The mechanical phenomena are the same as those which have been described as taking place in a left occipito-anterior position. First, flexion occurs, a process of accommodation, an adaptation of the presenting part to the birth-canal, by substituting a smaller head circumference to the pelvic area, a lessening of the fœtal part which descends first. Descent follows, and then rotation; but the occiput, instead of rotating from left to right, now rotates from right to left into the pubic arch. Extension occurs next, for direct progression of the occiput is impossible, because it is held back by the shoulders lying transversely, but indirect advance occurs by the occiput tending to approach the back, the chin departing from the chest, and the entire head is rolled out of the vulval opening; the head thus rotates backward upon its transverse axis in deflection, just as it rotated forward in flexion. After the birth of the head it rotates externally as the sign and the effect of internal rotation of the body, but the occiput now is directed to the mother's right thigh, the face to her left, which is the reverse of the situation of

these parts of the head in a left occipital position. By the direction in which this external rotation occurs the student may correct or confirm the diagnosis of position made at the beginning of labor. Finally, delivery of the body takes place in the manner described for a left occipito-anterior position.

Right Occipito-posterior Position. This is next in frequency to the position first described; it is that position reversed, and hence the occipito-frontal and the biparietal diameters hold the same relations to the two oblique diameters of the inlet that they did in left occipito-anterior position. The former of these fœtal diameters, which it will be remembered is the longer, avoids the left oblique of the inlet, which is practically the shorter of the two pelvic measurements, because of the presence of the rectum upon the left side. The occiput is at the right sacro-iliac joint, and the forehead at the left ilio-pectineal eminence; the back of the child is posterior and to the right, the limbs anterior and to the left side of the mother's abdomen.

Fig. 117.



Right Occipito-posterior Position.

Palpation proves the presence of the head in the lower part of the uterus; the hand can pass more deeply in the right side of the pelvis than in the left; in the latter it is arrested by the projecting forehead at the ilio-pectineal eminence. The dorsal plane of the fœtus can be more readily recognized if the woman lies upon her left side. The maximum of intensity for the fœtal heart-sounds is in a line passing from the right sacro-iliac joint to the umbilicus. Digital examination shows that the anterior fontanelle is in front and to the left, the posterior fontanelle to the right and behind, while the sagittal suture is in the right oblique of the inlet.

The mechanical phenomena of labor are in almost all cases the same as have been described, and therefore need not be detailed. One of these, however, requires special study—that of internal rotation. In occipito-anterior positions the occiput rotated only through a little more than one-eighth of a circle in order to be placed in the pubic arch, but

now it must rotate through three-eighths. Moreover, it sometimes happens that the shoulders do not rotate at all, or only partially, and hence there results greater or less torsion of the neck, this torsion being proved by the movement of restitution immediately following the delivery of the head.

It is natural to ask why the occiput when in this position, so near the sacral cavity, does not, as the forehead did, rotate, when in a somewhat similar location, into that cavity, instead of by a much longer course seek the pubic arch. Dr. Hodge's answer was that the promontory of the sacrum determines the whole head toward the anterior part of the pelvis, and that when the point of the occiput strikes upon the spinous process of the ischium rotation upon the right anterior inclined plane necessarily occurs, but if the point of the occiput strikes posteriorly to this process, rotation into the hollow of the sacrum follows.

But the most satisfactory reply to the question as to the anterior rotation of the occiput, and the posterior rotation of the sinciput, is, as stated by Dr. Ritchie, that in both anterior and posterior positions the former is lower than the latter when resistance begins; in occipito-anterior positions that resistance from the pelvic floor begins when the occiput is level with the pubic arch, and the forehead with the cavity of the sacrum, but in occipito-posterior positions the resistance begins when the occiput is past the sacral cavity, and the forehead too high for the pubic arch. There are forces of resistance presented to a progressive mobile at different levels, and consequently they cause it to rotate, the most prominent or advanced part of that mobile moving in the line of least resistance.

In the further consideration of this mechanical phenomenon we must bear in mind that unchangeable law which compels in all vertex deliveries, whether artificial or natural, the occiput to pass out first. When the flexion is perfect, the head and neck make, with the upper part of the thorax, according to the comparison of Dubois, a stiff, inflexible rod. If the occiput rotates into the pubic arch, the neck more than measuring the length of the pubic joint the occiput can pass out, and extension of the head occur, and thus the rod becomes flexible, and the trunk does not enter the pelvic cavity until the head is being delivered. But the condition is very different in an occipito-posterior position; the neck is much shorter than the lateral wall of the pelvis with which it is in relation, and hence the greatest diameter of the rod, the dorso-frontal, must enter the pelvic inlet, so as to be in relation with its right oblique diameter. But the descending back, curved and projecting, cannot rest upon the promontory of the sacrum, and hence there is a force of resistance which tends to throw the presenting part from an oblique to a transverse position. This change is possible only when flexion is perfect—that is, when the chin is so firmly pressed upon the chest that the head and upper part of the trunk make a unit, and thus a movement communicated to the trunk also causes the head to move. Meantime, on the other side of the pelvis the forehead is not adapted to the pubic arch, is resisted more by the anterior than by the lateral pelvic wall; thus the two resisting forces determine rotation of the head from an oblique to a transverse position, and then the rotation is

continued until the position becomes right occipito-anterior, from which the occiput finally turns into the pubic arch.

In rare cases—probably once in fifty, *Stoltz;* twice in fifty, *Uvedale West*—the occiput fails to rotate anteriorly, but turns to the sacral cavity, and the head is in an occipito-sacral instead of an occipito-pubic position. If this posterior rotation occurs, the head descends in the axis of the pelvis; but the occiput is not adapted to the concavity of the sacrum, nor the forehead to the pubic arch, so that both in front and behind space is lost. The straight, rigid rod cannot become flexible until the occiput has traversed the sacral cavity and the inner surface of the perineum, so as to pass out over its anterior margin; but this end is not possible until the trunk has also entered the pelvic cavity, for the longest diameter of the head is less than the distance from the inlet to the vulval opening. When the occiput escapes, the nape of the neck pivots on the anterior margin of the perineum, the occiput passing backward—extension occurring in like manner to that observed in an occipito-anterior delivery—and the anterior fontanelle, the forehead, and the face are successively delivered, all the diameters being suboccipital, just as in an occipito-anterior delivery.

After the head is delivered it drops down, and then follow in order external rotation of the head with internal rotation of the body, and delivery of the body. It is plain that the labor is slower in an occipito-posterior delivery, not only from the great distance the occiput must pass before it can escape from the vulval opening, but also from the difficulties in that passage; the suffering of the woman is greater, and there is more danger that the perineum will be torn. The child is born alive if it is not large and the pelvis is normal; but if the latter be small, or the former large, stillbirth is common.

In very rare cases, if the fœtal head was small, conversion of a vertex into a face presentation has occurred at the inferior strait, extension taking place, so that the chin instead of being born last is born first, emerging at the pubic symphysis, and the delivery of the head takes place by flexion.

It is unnecessary to give the diagnosis and describe the mechanism of labor in left occipito-posterior position, for they can be readily understood from the explanations already made, substituting left for right in the description of the diagnosis and the mechanism of right occipito-posterior position.

In concluding this exposition of the mechanical phenomena of labor in vertex presentation, it must be remembered they all concur to one end, the expulsion of the child, and therefore if one or another is not needed for this end, it may be absent. In the main they are processes of adaptation, of accommodation of the fœtal head and body to the birth-canal, and are the results of a driving and of resisting forces, hence varying as these forces vary. In some cases the fœtal head may be so small, or the mother's pelvis so large, that any increase in the head flexion is not needed for descent, flexion being essentially a lessening of size by placing a smaller head plane in relation with a greater pelvic plane; or, again, internal rotation of the head may not occur, and the head be born in the same oblique position which it had upon

entering the inlet. These and other variations in the mechanism of labor are not, as Pajot well says, violations of law, but occur because some of the factors which carry out the law may be absent, or others have more power. The phenomena as described always occur if the fœtal head, the birth-canal, and the driving force are normal. If, in a given case, two of these phenomena are simultaneous, it does not follow that their individuality as to causes, results, and diagnosis is lost, and that they should be regarded as a single event.

PRESENTATION OF THE FACE. In order that the face may present, the head must be extended instead of flexed, the occiput bearing the same relation to the back that the chin does to the sternum in vertex presentation.

FREQUENCY AND CAUSES. Authorities differ as to the frequency of presentation of the face: 1 in 324, Spiegelberg; 1 in 231, Churchill; 1 in 217, Lachapelle; 1 in 247, Pinard; 1 in 175, Depaul; 1 in 276, Galabin; 1 in 250 or 300 cases, Hodge.

Winckel has stated that thirty-three different causes have been suggested. One of the most remarkable was that given by Osiander, viz., that the fœtus inherited a disposition from its parents to carry the head back. Hodge[1] regarded as the best hypothesis that such presentation resulted from the spontaneous movements of the child, the head being fixed in this unusual posture by contractions of the uterus. Hecker regarded dolicocephalia as a cause. According to him, the greater projection of the occiput in the dolicocephalic increased the length of the posterior arm of the head lever, so that when uterine contractions occurred it ascended, while the frontal arm descended. The answer generally made by obstetricians to this explanation is that dolicocephalia is a consequence of the delivery in a face presentation, not the cause of such presentation, and that it disappears a few days after birth; further, even if this condition be present, the increase in the length of the occipital is never so great as to make it longer than the frontal arm. Spiegelberg met with a case of face presentation in a fœtus having hydrothorax. Other instances are mentioned in which tumors of the neck were the cause. But apart from these special causes, the general ones are uterine obliquity, pelvic narrowing, and unusual size of the child. The presentation occurs more frequently in multiparæ than in primi-

[1] Dr. Meigs said "that dead and half-putrid children, in whose tissues there is scarcely any resiliency or resisting power left, are not so unapt to come face foremost as living children, in whom departure of the chin from the breast occasions such a great extension of the head as to be painful, whence the living child instinctively opposes the wrong tendency, by acting with all its strength to get the chin back, or the head flexed again." The statement by Dr. Meigs, and also that by Dr. Hodge, suggest a voluntary movement of the fœtal head in the one case causing and in the other preventing presentation of the face, that is not unquestionable. Sir Thomas Browne, whose *Religio Medici* all doctors read, among his many other literary works wrote a supposed dialogue between twins in the uterus, which unfortunately has been lost. Imagining a conversation under such circumstances is, of course, a very wide step beyond, but is in the same direction as the voluntary movements that have been suggested. Those who have observed how utterly powerless the newborn are to move the head in any direction, and that it falls inert, according to gravitation will hardly admit that the fœtus can, against the force of gravitation, raise the head a single inch from the chest, or that when it is removed from the chest by external causes that the fœtus, though "acting with all its strength," can replace it if the slightest force opposes.

Winckel indorses the criticism of the opinion of Drs. Hodge and Meigs I have made. In Preyer's very interesting volume upon the *Soul of the Infant* the following statement is made upon the authority of Dremme, giving additional confirmation: In 150 children the head may be held in equilibrium if the infants are very vigorous toward the end of the third, or in the first half of the fourth month; in infants of medium force this is not seen until the second half of the fourth month, and finally, in infants less vigorous, somewhat below the normal in nutrition, not until the fifth or the beginning of the sixth month.

paræ, the proportion being, according to Kleinwächter, 1 of the former to 2.23 of the latter. The presentation may be primary or secondary; the latter is much the more frequent. The duration of labor is in primiparæ 34 hours, and in multiparæ 15 hours. The ordinary fœtal mortality in vertex presentation is 5 per cent., but in face presentation 15 per cent.[1] Premature rupture of the bag of waters, prolapse of the umbilical cord, and tearing of the perineum, are among the accidents liable to occur in face presentations.

Mechanism. As in presentation of the vertex the occiput was selected as the point of reference, so in presentation of the face the forehead, following the example of Depaul, will be chosen. Most obstetricians select the chin, naming the different positions of the presenting part mento-anterior and mento-posterior, right or left, according to the side of the pelvis in which the chin is placed. But let the student imagine a case of vertex presentation with the occiput at the left ilio-pectineal eminence, and then, while the fœtus is unchanged in its general position, let the head be extended instead of flexed, and it is seen that the forehead at once takes the position which the occiput occupied; and this position is the most frequent in presentation of the face. Further, in many cases, if not in the majority, presentation of the face is a deviated vertex presentation, and such deviation can be better understood with the nomenclature proposed. The various positions in presentation of the face will therefore be called right or left fronto-anterior and fronto-posterior.

Diagnosis. Pinard[2] states that examination of the pelvis enables us to recognize the presence of a large tumor at, above, or below the inlet, according to the period of labor at which the examination is made. Moreover, this tumor appears to occupy but one side, and is wanting at the other. Let the hand be now at once placed upon the fundus of the uterus, or both may be first put upon the sides of the uterus until the fundus is reached, and then one of them applied to it, and we find, usually upon the same side at which the lower tumor was prominent, the pelvis, that may be recognized by its peculiar characters. In order to follow and appreciate the resisting plane, it is indispensable[3] to depress slowly and deeply the abdominal wall, for this surface seems to bury itself in the abdominal cavity, while the superficial parts are readily felt. This is caused by the bending of the fœtus upon its dorsal plane. In operating properly one of the lateral planes can be examined, and it is readily ascertained that the portion of the cephalic sphere most accessible is in relation with the back. Moreover, between the back and the head there is, especially early in the labor, a deep depression into which the fingers sometimes readily enter. According to Budin,[4] one can, in some cases, recognize on the side opposite to the accessible tumor a clearly marked projection having the form of a horseshoe; it is formed by the inferior maxillary and the chin.

Charpentier regards the diagnosis by palpation alone as exceedingly difficult, stating that special conditions must be present, relaxation and thinness of the abdominal walls, and a non-irritable condition of the

[1] Kormann, quoted by Kleinwächter.
[2] Abdominal palpation.
[3] Pinard, op. cit.
[4] Op. cit.

uterus, in order thereby to make such a diagnosis, but it can be made by combining auscultation with palpation. The fœtus occupies a higher position than in vertex presentation, so that the maximum of the intensity of the heart-sounds is heard at, instead of below, the transverse line (Fig. 105); further, in consequence of the head being turned toward the back, the latter is removed from contact with the uterine wall, so that the sounds are heard better through the anterior wall of the chest; hence while the back is felt, for example, on the left side of the uterus, the heart-sounds are heard most distinctly upon the right side. This want of harmony between the results obtained by palpation and by auscultation leads to the diagnosis of a face presentation, for palpation would point to the conclusion that there was a vertex presentation, but auscultation, both by the fact that the sounds are heard higher up than in such a presentation, and on the opposite side to that upon which the back is found, justifies at least the suspicion that the face presents.[1]

After labor has begun, digital examination brings conclusive proof of the presentation. There will be found upon one side of the pelvis a round, hard part, divided in the median line by the beginning of the sagittal suture, and bounded by the fronto-parietal suture, and in the median line by the bregma; while upon the other side of the pelvis there is felt a smaller, softer, and irregular surface; this surface immediately next to the frontal bone offers two soft, round, small tumors, the globes of the eyes; there is a depressed surface between them, then from it there rises a projecting part which ends in two openings, the nares; below the nares and transverse to them is the mouth, into which the finger may be introduced, and in some cases this introduction is followed by efforts on the part of the infant to suck; below the mouth the chin is found, the direction in which it points being plainly indicated by the opening of the nares.[2]

If the labor has been in progress for some time, the membranes having been ruptured, the face becomes greatly swelled and its form changed; one feature, however, remains comparatively unaltered, the nose; by this the diagnosis of the presentation can usually be made, and when the nose is recognized the position is known, for the former points in a direction opposite to the forehead. The mouth should not be confounded with the anus, for the projection caused by the point of the coccyx is always readily found near the latter.

Left Fronto-anterior Position. This is the most frequent position. The back is found by palpation upon the left anterior side of the uterus; the fœtal heart-sounds are heard most distinctly upon the right side. Upon vaginal examination the nose is found pointing toward the right sacro-iliac joint, and hence the forehead must be at the left ilio-pectineal eminence.

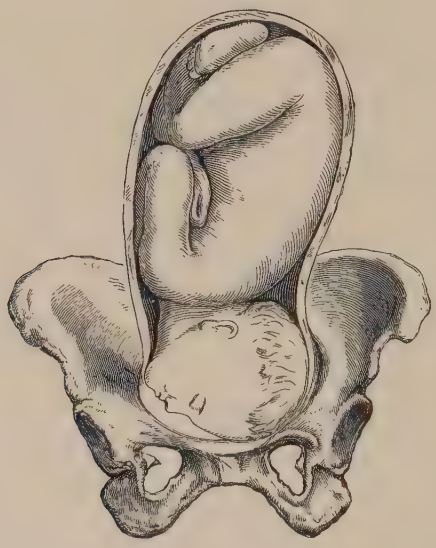
1. The first of the mechanical phenomena of labor is increase of extension, the occiput turned against the back; complete extension in presentation of the face corresponds with complete flexion in presentation of the vertex. Its cause is the driving force met by the unequal

[1] Fischel states the heart's action may be felt in face or brow presentation, when the anterior part of the chest lies in contact with the uterine wall, after rupture of membranes.

[2] Winckel states that in the diagnosis of this presentation chief reliance should be made upon recognizing the mouth and tongue.

resistance of the two arms of the face lever. In Fig. 119, A F, being the long arm, necessarily offers more resistance than A M, the short arm; hence the chin descends and the forehead ascends. Further, the head being already partially extended, prepares the way for complete extension. The result of perfect extension is: There is a lessened area of the head circumference brought in relation with the pelvic area, for, prior to complete extension, that circumference corresponded with a diameter passing from the chin to the bregma, the mento-bregmatic diameter, while now the diameter whose circumference occupies the pelvic area is the fronto-mental. There is no loss of force, at least after the waters have been evacuated and direct pressure upon the breech permitted, for the fœtus is no longer "a vacillating rod" in consequence of the mobility at the cervical vertebræ, but compacted together by the occiput being fixed upon the back. Complete extension is recognized by the recession of the forehead, and by the advance of the chin toward the centre of the pelvic cavity.

Fig. 118.

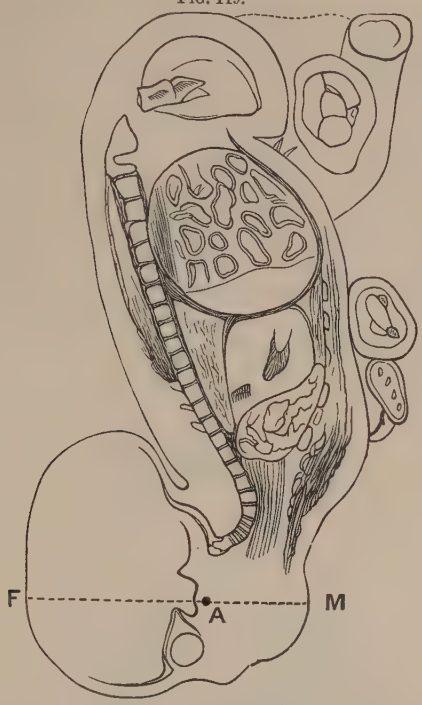


Fronto-anterior Position in Presentation of Face.

2. *Descent.* This does not need to be defined nor its cause explained.

3. *Rotation.* It is essential, in order that delivery can take place, in the ordinary relations of the size of the pelvis and that of the fœtus, that the chin rotate anteriorly; that must escape first before any flexion of the fœtal rod is possible. The descent is at an end as soon as the length of the child's head has been measured upon the pelvic wall, for then the chest tends to enter the pelvis, but the latter cannot accommodate both head and trunk. The length of the pelvic lateral wall is three inches and a half, between nine and ten centimetres, while the anterior wall is only one inch and a half long (four centimetres), a distance readily measured by the neck. Ordinarily, therefore, it follows

FIG. 119.



ATTITUDE OF THE HEAD IN PRESENTATION OF THE FACE.

that rotation of the forehead into the sacral cavity, and of the chin into the pubic arch, occurs before the face reaches the pelvic floor.

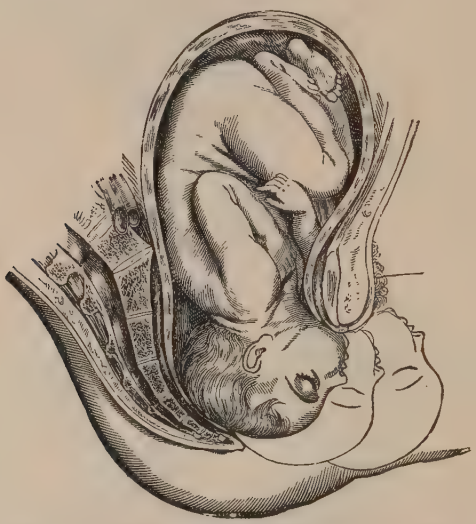
FIG. 120.

ROTATION FORWARD OF THE CHIN.

Dr. Hodge, however, with Velpeau and Chailly, held that in many instances "the chin will pass below the sacro-sciatic ligament, and will often distend the perineum to a great degree." He justified this opinion by the following considerations: First, the length of the neck is to be measured, not from the hyoid bone, but from the chin to the chest. When the head is in a state of extension we would have at least three inches and a half, and if the neck be elongated, probably four inches from the chin to the sternum. Second, the neck can be elongated to a considerable degree in these cases of great extension.

If these views were correct, we would probably have delivery of the fœtus in face presentation, without anterior rotation of the chin, as a frequent occurrence. Admitting, too, the great elongation of the neck claimed by Dr. Hodge, which, however, is of the anterior portion, this does not obviate the difficulty arising from both the head and chest occupying the pelvic cavity at the same time.

Fig. 121.



Passage of the Head through the External Parts in Face Presentation.
The head is becoming flexed and sweeping over the perineum.

The reasons for posterior rotation of the forehead are that it offers a more extensive surface, and the frontal arm of the face-lever is the longer, and hence meets with greater resistance; it finds more room and can be better accommodated behind than in front. With the corresponding rotation of the chin into the pubic arch the mental end of the face-lever is free; it no longer meets resistance from the bony wall of the pelvis, and the head is no longer pressed against the back, but can be delivered, thus giving room in the pelvic cavity for the descent of the body.

4. *Delivery of the head by flexion.* The chin escapes, and thus the occipito-mental diameter is free to rotate partially. The head is, as it were, rolled out of the vulval opening, flexion occurring, the throat applied to the summit of the pubic arch, the chin ascending over the pubic joint until the occipital end of the occipito-mental diameter

escapes over the perineum, when the head drops down toward the anus as it did after vertex delivery. Here again we have illustrated the fact that when one end of the long diameter of the fœtal head enters the pelvis, that end must pass out of it first.

5. *External rotation of the head with internal rotation of the shoulders.* The conditions are the same as in vertex delivery, and the causes of the rotations and the consequences are identical. The forehead, or the chin, always turns toward that thigh corresponding with the side of the pelvis which it occupied; thus, if the forehead was in relation with the left side of the pelvis, it turns toward the left thigh.

6. *Delivery of the body.* This is the same as in presentation of the vertex.

Anomalies of Mechanism in Face Presentations. In some cases there may be, in consequence of imperfect extension, presentation of the forehead. But this rarely persists, for either flexion occurs and the presentation becomes that of the vertex, or, and this is the more frequent, extension is completed and there is simply a face presentation. Sometimes, however, the forehead remains the presenting part, and is delivered first. The anomalies of the third time, rotation of the chin in front, are the most important. Not only may this rotation fail, but posterior rotation by which the chin turns to the sacral cavity may occur. Apparently spontaneous expulsion is impossible. Velpeau thought that flexion of the head might then take place by which the vertex would be substituted for the face. But this is impossible after the head enters the pelvic cavity if the fœtus and pelvis are of usual size. Cazeaux suggested that the soft parts might be depressed at the great sciatic foramen, "a depression permitting the chin to escape from the bony canal," so that the long diameter of the fœtal head might turn, and presentation of the vertex be substituted for that of the face. Another explanation was proposed by Dubois from two cases observed by him. The chin was behind and to the right, descent to the inferior strait occurred, and after the chin passed below the great sciatic ligament it depressed the soft parts so that space was gained to permit flexion of the head at the expense of the elasticity of the pelvic floor, and labor ended with presentation of the vertex.

Pajot remarks that in directly posterior positions, which are so rare that he has never seen one, that Chailly has suggested an analogous mechanism theoretically probable, permitting spontaneous delivery. The chin having reached the point of the coccyx, depresses the pelvic floor so that rotation of the occipito-mental diameter can occur, and the occiput is disengaged under the pubic arch. But whatever opinion may be suggested as to the termination of the labor in mento-posterior position,[1] practice demonstrates that they very rarely persist, and, moreover, when rotation of the chin does not occur, difficulties ordinarily arise requiring the intervention of art.

Plastic Changes. The form of the head is dolicocephalic; the longitudinal diameters are increased, the vertical and transverse diminished.

The face is greatly swelled and discolored; the eyelids likewise, and

[1] Pajot.

it is impossible for the infant to open them; in some cases the lips are so greatly swollen that the infant cannot nurse; very often subconjunctival hemorrhage is present.[1] The caput succedaneum occupies the inferior part of the malar region and the side of the mouth in fronto-posterior positions; on the contrary, it is situated upon the superior part of the malar region and even upon the eye in fronto-anterior positions. Mauriceau[2] has given a very graphic description of the appearance of a child's face after birth with facial presentation.

Right fronto-posterior position is the reverse of left fronto-anterior; and just as the former might be considered a deviation of the most frequent position of vertex presentation, extension taking the place of flexion, so that instead of the occiput the forehead is at the left iliopectineal eminence, so, imagining first the next most frequent position of vertex presentation, right occipito-posterior, we may suppose a deviation to result from extension taking the place of flexion, so that the forehead instead of the occiput is placed at the right sacro-iliac joint. The mechanism of labor is the same as has been described. 1. Completion of extension. 2. Descent. 3. Rotation. As the chin is so much nearer the pubic arch in this position than in left fronto-anterior, this process occupies much less time. 4. Delivery of the head by flexion. 5. External rotation of the head with internal rotation of the shoulders. 6. Expulsion of the body. It is only necessary to mention the names of the two other positions of face presentation, right fronto-anterior and left fronto-posterior, for a description of the mechanism of labor in these positions would be essentially a repetition.

Pelvic Presentations. Presentations of the pelvis are next in frequency to those of the vertex, and occur once in twenty to thirty cases in single pregnancies, but more frequently in twin pregnancies. Excluding cases of premature labor, pelvic presentations occur, according to Pinard, once in sixty-two.

Varieties and Causes. Usually the upper and lower limbs occupy the same position with reference to the trunk that they do in vertex or in face presentations. In some cases, however, not only are the thighs flexed upon the abdomen, but the legs extended over the chest. The knees may descend first, though, according to Spiegelberg, such presentation is never primitive, one or both feet may descend, but these various modifications do not affect the essential mechanism of labor. Whether knees, feet, thighs, or pelvis present, all are included

[1] A remarkable case of fatal hemorrhage from the conjunctivæ in an infant born with face presentation occurred, March, 1890, during one of my terms of service at the Philadelphia Hospital. Dr. Frank R. Keefer, maternity resident, had charge of the mother in her labor, and has given me a full report of the case, which I hope to publish with some comments at an early day. Suffice it now to say that the child was delivered spontaneously after a not unusually long labor; it seemed quite well, weighed eight pounds, and had only the usual appearance of a child born presenting the face. The bleeding began twelve hours after birth; the oozing was first from the conjunctiva of the right upper lid, and after a few hours from the palpebral conjunctiva of the left eye. In spite of various local means, some of which temporarily arrested the bleeding, the child perished of hemorrhage a little more than twelve hours after the first oozing appeared.

[2] In Mauriceau's Diseases of Women with Child, etc., translated by Hugh Chamberlen, and published in 1727, the great French obstetrician tells of a child being born face first, that "came with the face so black and misshapen as soon as it was born, as usually in such cases, that it looked like a blackamoor. As soon as the mother saw it she told me that she always feared her child would be so monstrous, because when she was young with child she fixed her looks very much upon a blackamoor belonging to the Duke of Guise, who always kept several of them. Wherefore she wished that, or at least cared not though it died, rather than to behold a child so disfigured as it then appeared. But she soon changed her mind when I satisfied her that this blackness was only because it came faceling, and that assuredly in three or four days it would wear away."

under the general name of pelvic presentations. Multiparity, premature labor, polyhydramnios, plural pregnancy, the fœtus being dead, or of small size, or hydrocephalic, pelvic narrowing, uterine tumors, and placenta prævia are the chief causes of pelvic presentations. In regard to the last, it is probable that it is not the fact of the placenta being prævia which causes pelvic presentation, but they both result from a common cause, the condition of the uterus.

FIG. 122.

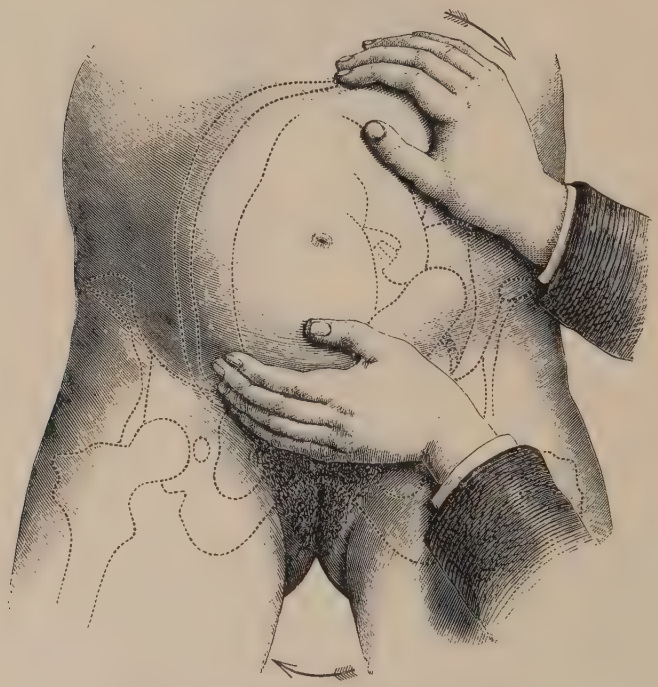
PELVIC PRESENTATION. RIGHT SACRO-ANTERIOR POSITION.

DIAGNOSIS. Before labor the pelvic cavity will be found empty, and the lower portion of the fœtal ovoid is partly in one or the other iliac fossa usually, and partly over the inlet; there will be found adjacent to this portion, except when the legs are extended over the chest, small movable parts; the head is in the proper portion of the uterus, and in the majority of cases at the right side, though in the illustration it is represented in the left, and cephalic ballottement may be made. Upon auscultation the maximum of intensity of the heart-sounds will be found above the horizontal line at Fig. 105.

Early in the labor before the presenting part has descended into the pelvic cavity, and the fœtal sac is entire, it will be difficult or impossible to make a diagnosis by vaginal examination. The bag of waters is large, and is sometimes described as "pudding-shaped;" such size and shape, and difficulty in reaching the presenting part, render it probable the presentation is pelvic. After the rupture of the sac and the descent of the pelvis, there usually is no difficulty in making a diagnosis. The finger touches a round object, but it is softer, less uniform in shape than the head, and has neither sutures nor fontanelles, nor the feeling of the scalp, wrinkled and covered with hair. The separation between the buttocks, the coccyx, the sacral crest, the anus,

and the sexual organs may be recognized; if the child be alive, the anus contracting resists the effort to introduce the finger, and the latter upon withdrawal will be covered with meconium. If the feet are pressed against the thighs, so that one of them may be touched by the finger, the diagnosis becomes easier. If the coccyx be felt, the position is at once known, for its point is always directed toward the anterior plane of the fœtus. If a foot only is accessible to touch, it is distinguished from the hand by being at a right angle to the leg, by its being thicker upon one side than upon the other, by the toes being placed in the same line, by the impossibility of separating the great toe

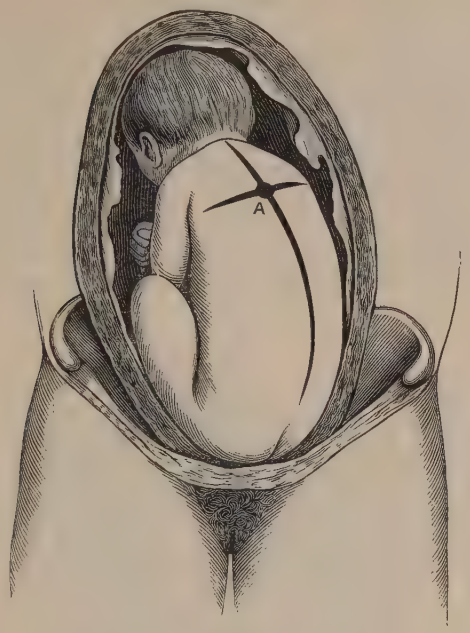
Fig. 123.



Diagnosis of Pelvic Presentation by Palpation.

from the second, and bringing the former in opposition to the other toes, as the thumb can be separated from the index finger, and brought in opposition to the fingers; the projection of the os calcis is also an important mark by which the foot can be distinguished from the hand. Presentation of a knee is very rare. The knee is broader than the elbow, and the patella flat, while the olecranon is pointed; the thigh and the leg, between which the knee is felt, are thicker than the arm and the forearm. If there still be uncertainty in the diagnosis, the member may be extended, and then the foot will be recognized. When the leg is extended the toes point to the anterior plane of the fœtus; but if the leg be flexed upon the extended thigh, the toes point to the posterior plane.

FIG. 124.



PELVIC PRESENTATION.
A, Place where sounds of fœtal heart are heard most distinctly in left sacro-anterior position.

MECHANISM OF LABOR. The positions are named according as the sacrum of the fœtus is anterior or posterior, in the left or right side of the mother's pelvis; thus we have four positions for pelvic presentation: 1, left sacro-anterior, the sacrum being at the left ilio-pectineal eminence, the most frequent position; 2, right sacro-posterior, the sacrum being at the right sacro-iliac joint; 3, right sacro-anterior; and 4, right sacro-posterior. Here, too, there are six stages, times, or processes in the mechanism of labor, as have been given in presentation of the vertex and in presentation of the face.

1. *Compression of the presenting part.* Just as a scattered crowd is brought into a compact mass in order to go from a ferry-boat to the landing-wharf, so the presenting part is compacted together, reduced to the smallest dimensions, in order that it can be transmitted through the birth-canal. It is a process of lessening, of adaptation of the passenger to the passage. In presentation of the vertex this process was by completion of flexion, and in presentation of the face by completion of extension; in all the changes there is a lessening of the presenting part, and the means by which the changes are effected are the same driving and resisting forces, and in all the purpose of the change is the same, the fœtal region is reduced to a form and size corresponding with the canal through which it must pass.

2. *Descent.* This needs no explanation.

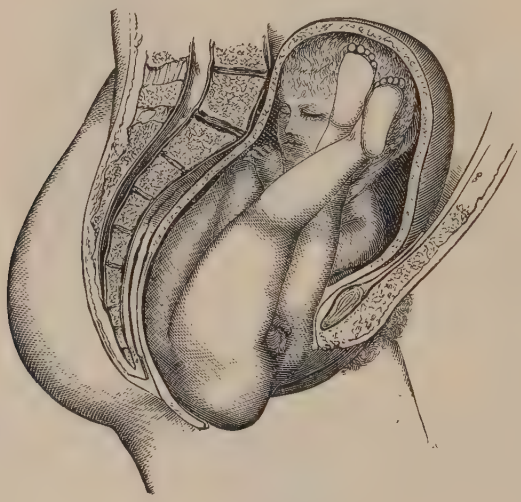
3. *Rotation of the anterior hip into the pubic arch,* so that the bis-trochanteric diameter is placed in relation with the antero-posterior

diameter of the outlet; this rotation includes the trunk of the child.

4. *Delivery of the body.* The anterior hip is at the pubic arch, and the posterior at the other end of the coccypubic diameter.

The pubic thigh remains fixed, forced against the subpubic ligament, and makes the pivotal point upon which, by partial curvature, the hips pass out; the posterior thigh sweeps along the perineal gutter, and the lower portion of the body is delivered, greatly latero-flexed. The anterior shoulder now descends into the pubic arch, is fixed there, while the posterior shoulder sweeps over the perineum and is delivered first, meantime the arms and forearms remaining closely applied to the chest.

FIG. 125.



EXPULSION OF THE BREECH.

5. *Internal rotation of the head and external rotation of the trunk.* This movement is designed to bring the occiput behind the pubic joint and the face into the sacral cavity. It is essentially the same as that which is observed in a vertex presentation, only it occurs last instead of first. Its purpose is to place the head in the most favorable position for expulsion, a suboccipital being brought in relation with the longest diameter of the outlet.

6. *Delivery of the head.* The head is forced down, the chin closely applied to the chest, the nucha pivots against the pubic arch, while the chin is born first, then the face, forehead, bregma, and, finally, the occiput emerge, the diameters presented being, as in head-first deliveries, suboccipital.

ANOMALIES IN THE MECHANISM. The only one of importance is that which may occur in the fifth time, arising from the failure of the occiput to rotate behind the pubic joint, but it rotates into the sacral cavity; the back of the child, instead of being anterior, is now posterior. The mechanism is different according as flexion of the head remains or

as extension occurs, the chin resting upon the chest in the one case, but departing from it in the other. In the former the nucha presses upon the anterior margin of the perineum, and the head is delivered by extension occurring, the chin, face, forehead, bregma, and occiput passing out in succession, the back of the child being turned toward the mother's back. But when the chin departs from the chest it is delayed above the pubic joint, extension is completed so that the occipital end of the occipito-mental diameter passes out first, then the rest of the head, delivery occurring by flexion, the throat pivoting upon the pubic joint; the abdomen of the child in the delivery comes toward the abdomen of the mother.

FIG. 126.

EXPULSION OF THE SHOULDERS.

PLASTIC CHANGES. The caput succedaneum is usually found upon the anterior thigh, but the swelling may also involve the external genitals, which are often greatly discolored. The head is remarkable for its round appearance; this arises from the fact that it is pressed at all points except at the top.

MECHANISM IN THE DIFFERENT POSITIONS. First. Left Sacro-anterior: 1. *Compression.* 2. *Descent.* 3. *Rotation.* It is unnecessary to give all the details. In this position the back is toward the mother's left side anteriorly, the sacrum at the left ilio-pectineal eminence, the bistrochanteric diameter is in relation with the left oblique, and the sacro-pubic with the right oblique of the inlet. The anterior hip, here the left, rotates from the right into the pubic arch.

4. *Delivery of the body.* The left hip is flexed at the pubic arch, pressing against the subpubic ligament; the right hip, passing over the sacro-coccygeal concavity and the perineal floor, emerges at the anterior perineal margin, the body of the fœtus being curved upon its lateral

plane. The shoulders descend—the bisacromial diameter has the same relation with the coccypubic diameter that the bistrochanteric had—and the trunk is entirely born.

5. *Internal rotation of the head and external rotation of the body.* The occiput turns from left to right behind the pubic joint, the chin firmly pressed upon the chest.

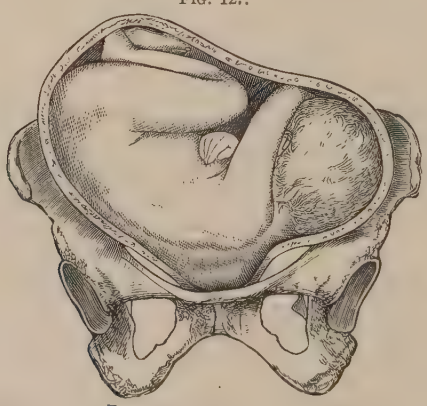
6. *Delivery of the head.* This occurs by extension, the chin passing out first, then the rest of the face, the forehead, the bregma, and the occiput —the back of the fœtus is directed toward the abdomen of the mother.

Second. Right Sacro-posterior Position. In this position the sacrum is directed to the right sacro-iliac joint. The right hip is anterior. The only difference in the mechanism from that observed in left sacro-anterior position is that the right hip turns from the right side in front. The mechanism in each of the other positions can be readily understood from the descriptions that have been given.

Presentation of the Shoulder. Either the right or the left shoulder may present, and for each there are two positions, depending upon the relation of the back of the fœtus to the abdomen of the mother, and hence known as dorso-anterior and dorso-posterior. Presentations of the right shoulder are somewhat more frequent than those of the left; dorso anterior positions are at least twice as frequent as dorso-posterior. Pinard, indeed, states that he never met, during pregnancy, with shoulder presentations unless occupying a dorso-anterior position. Shoulder presentations occur once in about 125 labors, Pinard; 6 to 7 in 1000, Kleinwächter; 1 in 297 Galabin gives as the proportion found from the statistics of Guy's Hospital Lying-in Charity.

Causes of Presentation of Shoulder. Smallness of the fœtus, its being dead, premature labor, polyhydramnios, peculiar shape of the womb, plural pregnancy, relaxation of uterine and of abdominal walls,

Fig. 127.



Transverse Presentation. Dorso-anterior. Presentation of Right Shoulder.

pelvic narrowing, and placenta prævia are given as causes. As to the last, the remark made in regard to pelvic presentations being similarly caused, is here also applicable.

Diagnosis. 1. Before labor begins, according to Depaul, the

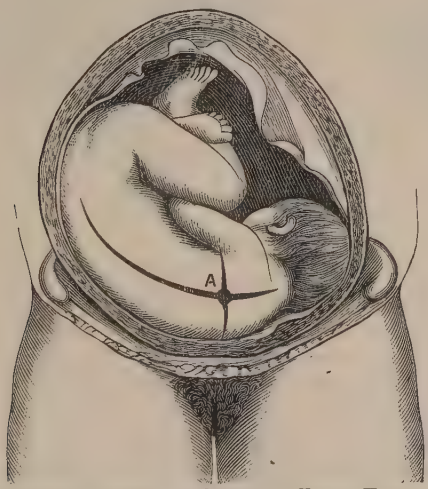
maximum of intensity of the fœtal heart-sounds is at the level of the line dividing the uterus in two equal parts, and the line of decrease of this maximum is horizontal, not vertical. This is shown in the illustration, Fig. 129.

FIG. 128.

TRANSVERSE POSITION. DORSO-POSTERIOR. PRESENTATION OF RIGHT SHOULDER.

By abdominal palpation the form of the uterus is found very different from the usual shape, being increased transversely; but it is a mistake to suppose, as is represented in some drawings, that the fœtus will be found lying with its head in one, its hips in the other iliac fossa; for

FIG. 129.



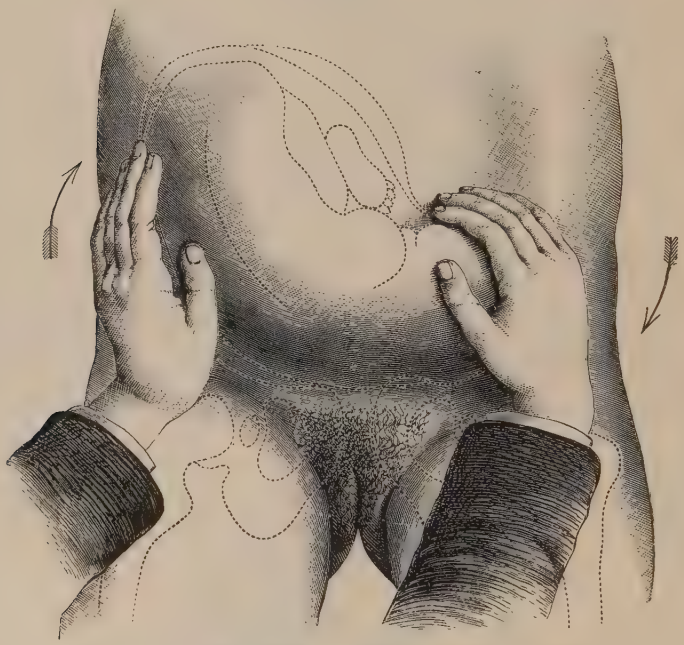
A, POINT OF MAXIMUM OF INTENSITY OF SOUNDS OF FŒTAL HEART IN PRESENTATION OF THE SHOULDER.

apart from any other reason the distance between the fossæ is much less than the length of the fœtal ovoid at or near term. The head is usually lower than the hips, for the shoulder, in most cases, is in relation with the pelvic area. Then by palpation the head is felt in one iliac fossa

while the breech is found in the opposite flank, and a resisting plane connects the two; cephalic ballottement is possible (Fig. 130). Vaginal examination is without value prior to labor.

During labor auscultation remains the same. The head is pressed nearer the inlet, and can be felt more distinctly, but ballottement is now impossible. The pelvic extremity is brought nearer the fundus of the uterus, toward the median line, and the resisting plane which unites the two ends of the fœtal ovoid is also brought nearer the vertical line.[1]

Fig. 130.



Showing Diagnosis of Shoulder Presentation by Palpation.

Depaul has dwelt upon the "peculiar physiognomy" of labor in case of shoulder presentation. The uterus does not contract with the same regularity that it does in vertex presentation; very frequently quite a long time passes in which the contractions come, are suspended, and then resume, without producing a marked effect; the os scarcely dilates, and sometimes twelve, twenty-four, forty-eight hours, or even more pass, without the part engaging in the inlet. The bag of waters is unusually large, and sometimes reaches down between the labia. If the presenting part cannot be reached by the two fingers, and auscultation and abdominal palpation have rendered it probable that the shoulder presents, it is better to introduce the hand into the vagina so that the diagnosis may be made certain. The shoulder is round, and presents a bony prominence, the acromion; but the most characteristic feature is the axilla, with the ribs parallel to each other, like the bars of a gridiron,

[1] Charpentier.

called by Pajot the intercostal gridiron. The cavity of the axilla formed by the arm and the wall of the chest represent an angle opening toward the hips, and its apex pointing toward the head; and hence when this is recognized the side occupied by the head is at once known. Next, the position of the breech is to be determined, whether anterior or posterior; this is done by feeling the scapula or the clavicle, the former corresponding to the posterior, the latter to the anterior plane of the fœtus; in some cases the spinous processes of the vertebræ may be readily felt.

If the elbow presents, it is recognized by being smaller than the knee, and the olecranon pointed while the patella is flat; if there be doubt, the forearm should be extended, and the hand will be readily recognized. The elbow, before the forearm is extended, points from the head. Should the hand descend, the means of distinguishing it from the foot mentioned in the diagnosis of pelvic presentation are to be used; there is usually no difficulty in making this diagnosis. But it does not necessarily follow that there is a shoulder presentation because the hand descends, for this may happen in presentation of the head, or of the breech, and therefore it is necessary by auscultation, by palpation, and by vaginal touch, to know that the prolapsed hand is not a complication of either of these presentations. Supposing the hand to descend in a shoulder presentation, it is important to know whether it is the right or left hand. Two very simple ways are presented; by following either, the question is answered. Put yourself in its place and shake hands, That is, let the obstetrician imagine one of his own hands occupying the same position, and he at once knows which hand. Or let him apply one of his own hands to the projecting hand, the right, for example; if palm corresponds with palm, and the thumbs are directly applied to each other, it is the right hand.

The hand[1] gives the shoulder; the back of the hand the situation of the head; the direction of the thumb indicates the direction of the breech; when the breech is posterior, the thumb is directed above from the side of the pubic joint; if the breech is anterior, the thumb is directed below, toward the anus.

Three modes of spontaneous delivery may occur in shoulder presentations:

1. As observed by Roederer, Kleinwächter, and others, the fœtus may be delivered doubled; but this is only possible when it is small, very flexible, and compressible.

2. Spontaneous version, by which the head or breech is substituted for the shoulder, may occur; if the head take the place of the shoulder, the change is known as cephalic version, but if the breech, pelvic version. Spontaneous version has been attributed to the active movements of the fœtus and to irregular uterine contractions. It would seem more natural to explain the change as resulting from the uterus taking, though tardily, its normal ovoidal form, and compelling the fœtal ovoid to occupy its corresponding position.

3. Spontaneous evolution is the term given to the delivery when, the

[1] Charpentier.

shoulder still presenting, a series of changes, or mechanical phenomena essentially the same as those that have been described in connection with delivery in other presentations, take place. These are:

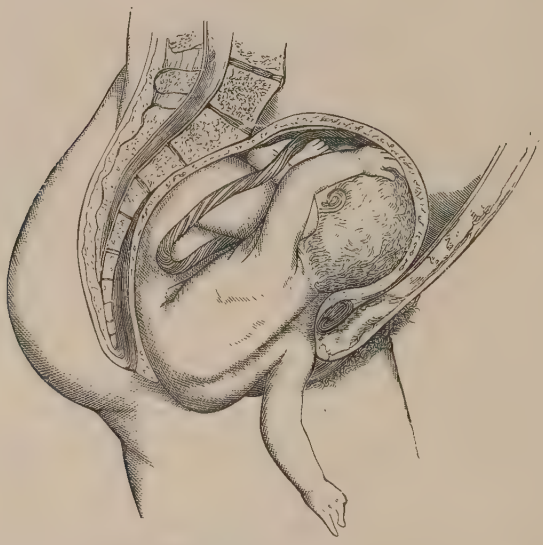
1. *Compression*, by which the presenting part is lessened and thus adapted to the canal through which it must pass.

2. *Descent.* This stage requires no description.

3. *Rotation of the shoulder into the pubic arch.* These three stages occupy considerable time, during which the fœtus in most cases dies. The shoulder is the smallest part of the fœtal wedge, and hence advances first, driven in the direction of least resistance. With the rotation of the shoulder the head moves anteriorly and is fixed above the pubic joint.

4. *Delivery of the body.* The anterior shoulder remaining fixed at the subpubic ligament, the posterior shoulder is forced down the sacro-perineal curve, the body being strongly latero-flexed. By referring to Figs. 131 and 132, it is seen that the right shoulder is anterior and remains fixed, while the left or posterior shoulder is driven further down; the latter finally passes out at the anterior margin of the perineum, and is followed by the chest, abdomen, and hips, and then the anterior shoulder is delivered, the head only remaining in the pelvis.

FIG. 131.



SPONTANEOUS EXPULSION. FIRST STAGE.

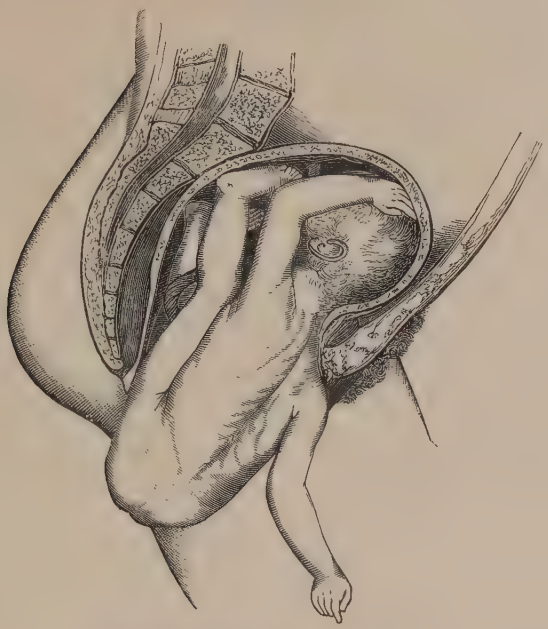
5. *Internal rotation of the head and external rotation of the body.* This is the same as that which occurs in pelvic deliveries.

6. *Delivery of the head.* This, too, is the same as in pelvic deliveries.

CAPUT SUCCEDANEUM. This is situated upon the shoulder which has presented; when the arm prolapses, it also is swelled and discolored, and frequently is the seat of phlyctenulæ.

Of course, shoulder presentations are not trusted to spontaneous delivery, but demand the intervention of art. Nevertheless, it was

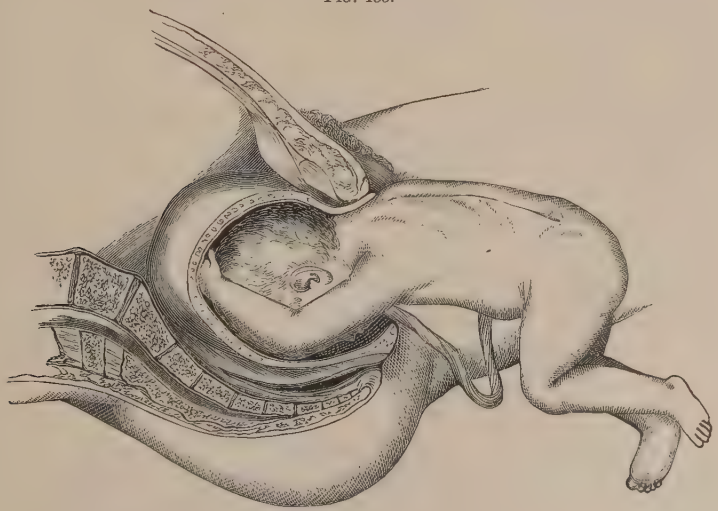
FIG. 132.



SPONTANEOUS EXPULSION. SECOND STAGE.

important to present nature's method of dealing with these abnormalities. The student will recognize the truth of the statement made at the beginning of this exposition of the mechanical phenomena of labor, that there is a unity in this mechanism, one general plan, one common end. That this may be made, if possible, still clearer, the

FIG. 133.



SPONTANEOUS EXPULSION. THIRD STAGE.

following table, including the different presentations, with the associated mechanical phenomena of labor, is given:

Vertex Presentation.	*Face Presentation.*	*Pelvic Presentation.*	*Shoulder Presentation.*
1. Flexion of the head.	Extension of the head.	Compression of pelvis.	Compression of shoulder.
2. Descent.	Descent.	Descent.	Descent.
3. Rotation of head.	Rotation of head.	Rotation of pelvis.	Rotation of shoulder.
4. Delivery of head.	Delivery of head.	Delivery of body.	Delivery of body.
5. Internal rotation of body.	Internal rotation of body.	Internal rotation of head.	Internal rotation of head.
6. Expulsion of body.	Expulsion of body.	Expulsion of head.	Expulsion of head.

Prognosis of Vertex, Face, and Breech Presentations. Auvard gives as the mortality for infants, when the vertex presents, 1 per cent., in facial presentation 5 per cent., and in pelvic 10 per cent. But this is too favorable. If the vertex present and the position is occipito-anterior, the mortality, according to Winckel, is 2.5 per cent. But in an occipito-posterior position, with rotation posteriorly, more than 15 out of 100 perish. In presentation of the face 13 per cent. are born dead, and 7.5 per cent. asphyxiated. Pelvic presentations give a mortality of about 20 per cent.

In regard to the infant mortality in pelvic presentation, Runge states that it varies, according to different authorities, between 9 and 37 per cent.; Kaltenbach says it is 10, 20, even 30 per cent. Porak, on the other hand, gives 1 infant dead in 9 primiparæ and 1 in 30 multiparæ. A proper conduct of the labor will certainly give a less mortality than that which has been quoted from eminent German authorities.

CHAPTER XII.

THE CONDUCT OF LABOR.

HAVING considered the phenomena of labor, its conduct or management is now to be presented. Giving birth to a child, though a physiological function, differs very materially from any other function of the organism. These differences are duration, suffering, and traumatism. Intelligent art may in many instances shorten the first, and lessen the second and third. Even admitting that the savage woman[1] safely brings forth alone, or with only an ignorant attendant, the civilized woman is in many instances very far from being in a physiological condition, and thus childbirth brings to her peculiar pains and perils; her higher development renders her more susceptible to bodily suffering, and in many instances has been attained by the partial sacrifice of physical endurance and vital force. Moreover, in cases of labor for a time advancing favorably, sudden accidents imperilling the life of mother or of child may arise, and professional knowledge and skill be needed to meet them; while the common *rôle* of the obstetrician is "to observe, to control, to alleviate, and to protect," emergencies may come which demand his promptest action and greatest ability, though it is only in a small minority of births, not more than five per cent., any other interference is required. It is, therefore, important, in her own interest and in that of her offspring, that woman should have in labor a qualified professional attendant.

Two important questions, the one relating to antisepsis, the other to anæsthesia, may be considered at the beginning of this exposition of the obstetrician's duties.

ANTISEPSIS. With our present knowledge of the gravest diseases which affect the lying-in woman, it is very probable they are caused by microscopic germs; hence it is important that woman in labor should as far as possible be protected from the presence of such germs, and their entrance through the necessary or accidental traumatisms of labor be prevented.[2] As part of the means for the attainment of this end, it

[1] The following statement is made by Dr. Engelmann in his very interesting volume, Labor Among Primitive Peoples, p. 7: "Among primitive people, still natural in their habits and living under conditions which favor the healthy development of their physical organization, labor may be characterized as short and easy, accompanied by few accidents and followed by little or no prostration."

If birth were as easy as that of Wenonah in Longfellow's song of Hiawatha, obstetricians would never be needed:

"There among the ferns and mosses,
There among the prairie lilies,
On the Muskoday, the meadow,
In the moonlight and the starlight,
Fair Nokomis bore a daughter."

[2] The testimony given by lying-in hospitals in regard to the value of antiseptics in greatly lessening not only mortality but morbidity is so large and clear that no intelligent and conscientious practitioner can deny that system or wisely ignore the use of such agents. The mortality has been reduced to one-half per cent. or less, and the statistics of Schuster, of Innspruck, show that of the women delivered there, 93.1 per cent. did not have any febrile temperature.—Centr. f. Gynäkol., 1888.

is important that the lying-in room be well ventilated and free from disease germs or from the poisonous influence of sewer-gas. I have seen in consultation a case of puerperal septicæmia in a multipara who occupied a room in which three months before two of her children were ill with diphtheria; in another patient the lying-in room had a washstand communicating with a badly drained sewer; in a third the disease apparently had its origin in connection with scarlet fever, the husband, a physician, attending some malignant cases of the disease immediately before and after his wife's confinement, and spending most of his time in her room.

Thorough disinfection of the room which the patient is to occupy should be made, if it has been previously occupied by one suffering with scarlet fever, with erysipelas, or diphtheria, or with any disease attended with suppuration, as uterine cancer in its advanced stages; it would be better, indeed, for her lying-in to be in another house or other room. The room, too, should be free from the effluvia of decaying animal matter. If there be any sewer communication in it, as, for example, from a permanent washstand, that communication should be, for the time at least, cut off. The obstetrician must know that the nurse has not recently been in attendance upon any of the forms of disease that have been mentioned, and especially upon a case of puerperal septicæmia.

Antisepsis of the Patient. It is advisable for a woman at the beginning of labor to have a whole bath, or a hip-bath; after this the external sexual organs are washed with warm water and soap, and then with a disinfectant solution, *e. g.*, 3 per cent. of carbolic acid or 1½ per cent. of lysol, or a mixture of creolin and water may be employed. Vaginal injection, or irrigation, is not indicated unless there be a purulent discharge, or the labor is protracted; the antiseptic used in the former case may be one part of corrosive sublimate to two thousand of water.

Antisepsis of the Obstetrician. In addition to what has been said on this subject, page 190, the peril of the patient being greater in consequence of the traumatisms of labor, and the danger of infection by the physician being increased, because it may be several examinations are made instead of one, so his precautions must be more complete. If his fingers have touched infectious matter, not only the thorough washing with soap and water that has been previously mentioned—here especially the use of sand and green soap is one of the best means of mechanical disinfection—but before immersing them in the corrosive sublimate solution they are to be washed with 80 per cent. of alcohol.

Ribemont-Dessaignes and Lepage say that there is not a single obstetric antiseptic which is good on every occasion. Corrosive sublimate, which is a perfect microbicide in practice, is an agent that must be prudently employed, because of its toxicity, and because of the accidents which it produces when absorbed in considerable quantity. The biniodide has been proposed as a substitute, but Tarnier states that it has less antiseptic power and presents as great danger of poisoning.

Naphtaline, or the naphtolate of soda, is an excellent antiseptic, 4 to 1000 of water; it has proved useful both as a vaginal and uterine

injection. But it must be freshly prepared, in order that it may have sufficient solubility, and therefore it can hardly come in general use.

The sulphate of copper has proved useful, but it has also been found dangerous. Boric acid has not great antiseptic value, but it is to be observed that Kaltenbach, after suggesting a 5 per cent. mixture of carbolic acid and oil, or vaseline free from germs, for anointing the finger which is used in touching, commends lanolin, more especially Graf's boro-glycerin-lanolin kept in tin tubes.

Potassic permanganate[1] in solution has been used as an antiseptic, but the stains which it leaves have made it objectionable.

The use of antiseptics after labor will be considered in connection with the management of the puerperal state.

Anæsthesia. Historical. Early in 1847 the illustrious Sir James Y. Simpson proved that inhalation of sulphuric ether could be safely and successfully used for the relief of pain in childbirth, and later in the year he established the same fact as to the inhalation of chloroform. Obstetric anæsthesia soon found a few in Great Britain and on the Continent to advocate and practise it. In the United States, Dr. N. C. Keep, of Boston, was the first American physician to administer an anæsthetic in labor. But Dr. Walter Channing was the most distinguished of American physicians advocating the practice; his treatise on *Etherization in Childbirth* was published in 1848. The late Professor Henry Miller, of the University of Louisville, gave chloroform to a woman in labor on the 13th of March, 1848; this was the first time that chloroform was thus used west of the Allegheny Mountains. Dr. Miller remained faithful to anæsthesia in labor the rest of his honored life; he strongly advocated the practice, and with his well-known ability answered the arguments adduced against it. Channing and Miller are the two names that in this country shine with the most lustre in connection with the early advocacy of obstetric anæsthesia.

On the other hand, three of the most eminent obstetric teachers, Meigs, Hodge, and Bedford, strongly opposed the use of anæsthetics in normal labor, and their influence was more powerful than that of its advocates. The controversy here was but the reflex of that which was occurring in Great Britain. Simpson asserted that it was only a question of time as to the general adoption of anæsthesia in parturition. On the other hand, Dr. Ashwell, who, with Tyler Smith and Ramsbotham, were the most prominent London obstetricians opposing the practice, declared that "unnecessary interference with the providentially arranged process of healthy labor is sure, sooner or later, to be followed by injurious or fatal results," "that chloroform need only be extensively used to insure its entire abandonment," and that it was "a duty to urge every plea against its further use." More than thirty-five years have passed since these words of Simpson and of Ashwell were uttered; the prophets are dead, but the prophecy of neither has been fulfilled; chloroform has not been generally adopted, nor has it been entirely abandoned in obstetric practice.

Doubtless the influence of Drs. Meigs, Hodge,[2] and Bedford did much in this country to prevent the use of anæsthetics in labor. It is certain that the great majority[3] of women in the United States endure the martyrdom of maternity without anæsthesia. On the other hand, it often happens that a brief surgical operation, in many instances much less painful than childbirth, is not done until the subject is anæsthetized.

[1] In Dr. Hunter Robb's useful volume, Aseptic Surgical Technique, the author, in describing the process of sterilizing the hands, advises after they have been immersed in a warm saturated solution of permanganate that they should be next washed in a warm saturated solution of oxalic acid, and adds: "Experiments made by Dr. Mary Sherwood, in the Pathological Laboratory of the Johns Hopkins University, have shown that in this process the oxalic acid and not the permanganate of potassium is the essential disinfecting agent."

[2] And yet Dr. Hodge, while refusing the parturient the relief to be had from chloroform, indicates the severity of her suffering by saying that she is "agonized and semi-delirious."

[3] For example, in the Summary of Obstetric Cases reported by members of the East District Medical Society, and compiled by Dr. Samuel W. Abbott, Boston Medical and Surgical Journal, July 6, 1882, in only twelve per cent. were anæsthetics used; as showing the great preference by New England physicians for ether, it was used in 323, and chloroform in only 2 cases.

Anæsthetic Means. Chloroform[1] is preferred by most to ether, because of its pleasanter odor, its prompter action, and the less quantity required. Though various means have been recommended to produce obstetric anæsthesia, not one is perfect. If there could be found some agent which, while annulling pain, would have no injurious effect upon uterine contractions, lessening their force and frequency, invariable in its action, and leaving no unfavorable conditions, it would be the best boon to women enduring the martyrdom of maternity. Chloroform and sulphuric ether come nearer meeting these requirements than any other of the various means that have been recommended. The bromide of ethyl, according to Kaltenbach,[2] only exceptionally has a favorable action, and is transitory, and moreover is liable to leave irritation of the respiratory mucous membrane. The combination of laughing-gas and oxygen, 4 : 1, cannot often be readily had, and a sufficient supply would be cumbersome. Hypnotism is uncertain, only few readily and completely yield to its influence, and seldom does the obstetrician possess hypnotic power; moreover, neuroses may follow its employment. Chloral is warmly recommended by some obstetricians, fifteen to twenty grains every thirty minutes until pain is lessened, and it may be given by mouth or rectum; but it is slowly absorbed, and it cannot be as well regulated according to the needs of the case as anæsthetic inhalation. The local application of cocaine is very limited in its adaptability, the exposure of the genital canal in pencilling the cervix, for example, is not a matter of indifference so far as the future safety of the patient is concerned. The effect is transient, and, finally, an injurious amount of the drug may be absorbed.

Kaltenbach objects to chloroform on the ground that it lessens the number, duration, and force of the uterine contractions. Ahlfeld[3] states that hemorrhage in the placental period is more liable to occur if chloroform has been used, partly from the feebleness of uterine contractions, and partly from the lessened coagulability of the blood. He also believes it dangerous to the child. Since the first of 1893 Ahlfeld has used ether, and is quite satisfied with it.

Kaltenbach believes that ether has a less unfavorable effect than chloroform, and that acting as a cardiac stimulant it is of service in the anæmic. Ribemont-Dessaignes and Lepage,[4] considering only chloroform in labor, observe "that in the great majority of cases women ought to be delivered without chloroform; but that in some whose nervous system is too excitable, or if the uterus contracts with too much violence, resort to chloroform analgesia may be made, especially if the patient insists upon it." Martin[5] says that the severe suffering can be blunted by superficial narcosis without interfering with the abdominal pressure, and that a few drops of chloroform may be given by inhalation at the beginning of each pain in the second stage of labor; but if this stage is long, the energy of the abdominal pressure is occasionally thereby injuriously affected.

It is quite evident from the statements of authors referred to that the

[1] The late Dr. Fordyce Barker informed me that he always used chloroform, and that he used it in all cases of labor.

[2] Op. cit. [3] Op. cit. [4] Op. cit.

[5] Lehrbuch der Geburtshilfe, 1891.

employment of anæsthesia in labor is far from general, and is even hesitatingly employed.

The writer knows but little from personal experience of the employment of chloroform, but he has frequently used ether, and his belief is that the latter may be safely[1] and beneficially employed in the second stage of labor in the majority of women. But the practitioner should remember that the anæsthesia must be neither continuous nor profound; intermittences in the administration are important, and at no time must the intelligence and will of the patient be suspended.

Dr. J. C. Reeve, in his contribution to the *American System of Obstetrics*, "On the Use of Anæsthetics in Labor," denies that ether is a safer anæsthetic than chloroform, and after a careful study of accidents from chloroform in labor makes the following statements:

1. But one well-authenticated case of death is on record where the administration was by a medical man, and in that case no autopsy was held.
2. Dangerous symptoms have occurred but a very few times, and then almost always from violation of the rules of proper administration.
3. The danger when chloroform is used only to the extent of mitigation or abolition of the suffering of childbirth is practically *nil;* when carried to the surgical degree for obstetric operations, the danger is far below what it is in surgery.
4. No proof can be furnished that the parturient woman enjoys a special immunity from the danger of anæsthetics, although facts seem to indicate that such exists. Her best safeguard lies in the care and watchfulness of the administrator.

If chloroform be employed, it may be inhaled from a handkerchief or small napkin, upon which half a teaspoonful is poured at a time; the napkin or handkerchief is held close to, but not touching, the patient's nose. For the administration of ether an extemporaneous inhaler may be made by first making a cone of a stiff towel, then this cone is surrounded at the sides and covered upon the top by thick, firm paper; a sponge as large as the fist is pressed into the cavity of the cone and saturated with ether, being careful that the quantity is not so great as to drip upon the patient's face when the instrument is used. The hollow base of the cone is now placed so as closely to encircle the patient's mouth and nose. The anæsthetic is not to be used except just before and during a "pain," the purpose being not to cause unconsciousness, but to lessen or remove suffering while intelligence and will remain in full exercise.

Anæsthetic inhalation is used in the second, rarely in the first stage of labor. It may, however, exceptionally be of value in the latter; for example, in the case of a primipara if the "pains" are unusually severe and the os dilates very slowly, the new experience wearies, weakens, and disheartens her, and great nervous irritability ensues; but now blunt the sharp edge of her suffering by an anæsthetic, and a happy change may occur in her mental and physical condition. In general, the indication for anæsthesia is great suffering, no matter whether this occur in the first or in the second stage of labor. Dr. J. C. Reeve, of Dayton, Ohio, whose name is so well known in connec-

[1] Porak, Société Obstétricale et Gynécologie, of Paris, 1890, stated that chloroform appears to offer the least uncertainty as an obstetric anæsthetic, but he also said that the more rapid elimination of ether probably renders it less dangerous.

tion with the subject of anæsthesia, states[1] that "the periods of labor to which it is best adapted are two: when distention is greatest of the os, and of the vulva. The kind of labor where it does best is that in which energy of contractions is great and expulsive force is in excess of dilatation."

In all cases the practitioner will be guided by the effect of the anæsthetic, withholding, lessening, or increasing, as may be indicated; he will never carry the anæsthesia so far as to suspend consciousness, unless during the birth of the head, and after it is born the use of the anæsthetic should stop.

Special Directions. Prompt attendance is important when called to a case of labor, for though in most instances the call comes earlier than necessary, yet occasionally the presence of the obstetrician may enable him easily to correct an unfavorable presentation, which later may prove difficult or impossible, or arrest a dangerous hemorrhage, or avert an attack of eclampsia.

The following articles should be carried by the accoucheur: A stethoscope, a flexible catheter, a preparation of ergot, a solution of morphine, or tablets for preparing such solution for hypodermatic use, and syringe, sulphuric ether, two or three long needles with silk, silkworm-gut, or properly prepared catgut, to be used if the perineum is torn, and, if the patient lives at considerable distance, an obstetric forceps.[2]

If the patient has not already been provided with a fountain syringe, with an antiseptic solution, and an anæsthetic—chloroform, or ether, or a solution of chloral—the obstetrician should carry these too; on the other hand, if the anæsthetic selected be ether, and she has a supply, it will be unnecessary to include it in the list first mentioned. Upon arrival it is better that he should not immediately enter the patient's room, even if previously knowing her; especially if a stranger, and taking the place of her expected attendant, his coming should be first announced, for an abrupt entrance may have an unfavorable effect upon her. Admitted to her room, it is rarely necessary for him to make an immediate examination, or even at once to inquire as to her present condition; for a time at least, it is better for him to get his information indirectly, by observing the character of her pains, their frequency, regularity, and the apparent suffering they cause. Let him so guard his words and acts that no offence be given to woman's modesty, which is at once her ornament and defence. Physical suffering hushes the cry of shame, and until this occurs many a woman will shrink from a vaginal examination, especially if abruptly proposed. The obstetrician should be a gentleman, gentle in his ways and words, and yet firm in conduct; he among all men must have the *suaviter in modo* as well as the *fortiter in re*.

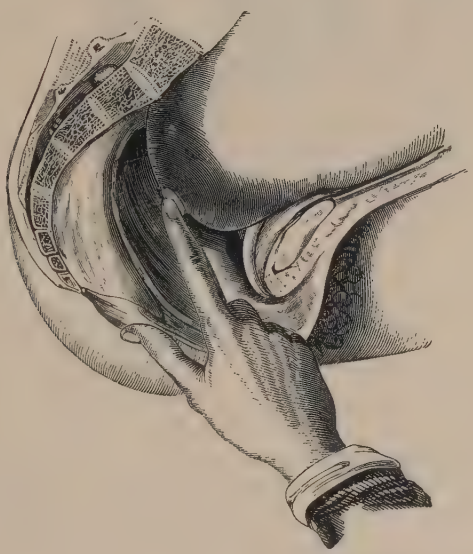
Two questions are to be decided by the professional attendant when in the presence of a patient supposed to be in labor. First, is she pregnant? Second, has labor begun? A woman is very rarely deceived as to the fact of her own pregnancy, but occasionally she may have a false

[1] Private communication.

[2] The conservatism of Blundell did not permit taking instruments. "Lead not yourselves into temptation; if you put your instruments into your pocket, they are very apt to slip out of your pocke's into the uterus."

instead of a true pregnancy, and the physician must have the possibility of such occurrence in his mind. Provided the professional attendant does not already know, inquiry is made as to the date of the last menstruation, and as to that of "quickening;" so the question may be asked as to the premonitory symptoms of labor; if she has been previously confined, the character of the labor or labors should be ascertained. Next, inquiry may be directed as to her present condition, how long she has been sick, whether the "pains" are regular in recurrence, whether increasing in frequency and severity, and where they are felt; whether she has other suffering than that of labor, headache, for example, and whether there have been recent and free discharges from the bladder and rectum. The necessity for an examination, if she does not already know

FIG. 134.

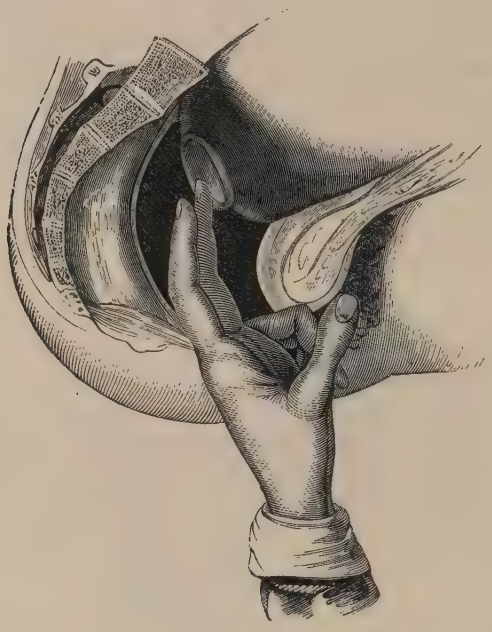


EXAMINATION IN LABOR WITH INDEX FINGER OF RIGHT HAND, THE OS UTERI JUST OPENING.

it, is explained to her, and as a rule her consent is readily given. The physician retires from the room while the nurse makes the necessary preparations by arranging the person and the clothing of the patient. Very commonly, upon his return, the woman will be found lying upon the side with the hips near the edge of the bed, this position being taken as less offensive to modesty. Though a vaginal examination can, in most cases, be made more satisfactorily if the woman be in the dorsal position, and this position is essential for abdominal palpation, an immediate change need not be required, but after examining while she is lying upon the side, she may be requested to turn upon the back, and the exploration continued and completed. After the examination, external as well as internal, the methods and purposes of which have been fully explained, and the physician finding a normal presentation with favorable position, vigorous and regular action of the uterus, and good

condition of the birth-canal, he should frankly tell the woman and her friends that "everything is right," according to the stereotyped expression, or make some equivalent statement.

Fig. 135.



Examination in Labor with Two Fingers of the Left Hand, the Os Uteri more Dilated.

Possibly the patient, after being informed of the favorable condition of affairs, asks how soon the labor will be over. The question is sure to come sooner or later, and to be anxiously and wearily repeated if the labor be long. Let the obstetrician beware of a positive answer, especially if it be the first stage of labor, and if a primipara, for the remorseless clock may contradict his prediction at the sacrifice of all her hopes and of her confidence in him. Velpeau remarked:

> The accoucheur who, in order to make a show of vain wisdom, thinks himself capable of telling exactly when the labor will terminate, not only exposes his ignorance or his bad faith, but he compromises the honor of his art and the safety of his patient. Gooch, referring to parturition in a primipara, said, "I am never fool enough to state any time within which the labor will be over."

It sometimes happens that the first stage is brief and the second protracted; or, again, the first unusually long and the second very short; and hence any answer as to the duration of the labor, founded upon the presentation and position, the primiparity or the multiparity of the patient, the condition of the soft parts, the proportion between the presenting part and the birth-canal, derived from observing the rate of progress in a definite time, can only be a probability and an approximation to the truth, and should be so stated. Here, as in the general

relations of physician and patient, the laws of truth must be observed, not that in all cases the patient is to be informed of any great peril that threatens her, but, on the other hand, let no falsehood ever be told her. Lying to patients, though the motive may be a kind one, never brings any good in the long run; and he who does it leads himself into temptation to be untruthful upon other occasions, even if he does not forfeit his claim to be believed in all matters, and loses his own self-respect and also that of those who know him.

It is well to explain to her, if this is her first experience, the different stages of labor, the value of voluntary effort in the second, and its inutility and injury in the first period. Better, too, that she[1] should know what she has to endure, and the greatness of her suffering be acknowledged, rather than treat it as being slight; and never try to cheat her with false hopes and promises that will not be fulfilled. We are dealing with a rational being, and intelligent faith, will, and conscience are a stronger support in the endurance of great suffering than blind hope and unfulfilled predictions.

PREPARATION OF THE BED AND OF THE PATIENT'S PERSON. These duties are generally attended to by an intelligent nurse; but sometimes the nurse is not intelligent, or the patient may be too poor to employ one, or the labor ends before her coming, and in such emergencies the practitioner must direct or make the necessary preparation of the bed. The bedstead should not be close to the wall, but accessible at each side; a firm mattress is laid upon it, and over the mattress a piece of rubber sheeting, oilcloth, or tarred paper to protect it from the patient's discharges,[2] for these absorbed by it would cause both discomfort and danger. Above the protective material an old quilt or comforter, first folded lengthwise, and then transversely, is placed on that part of the bed where the patient's hips will rest, and above this a sheet similarly folded. Now let a sheet be spread in the usual manner upon the bed, then folded from below above so that the fold will come higher than the quilt and sheet which have been put in place; this sheet is thus arranged that it may be protected from being soiled during labor, and after that has ended, and all wet clothes have been removed, it can be drawn down under the hips and to the foot of the bed, thus securing, with the least disturbance of her person, a dry, clean, and warm sheet to lie upon.

Instead of the method just given, it is very common to have the under sheet extend over the rubber cloth to the foot of the bed, then upon this there will be placed a draw-sheet, made by folding a sheet four times in its length, and put

[1] The great poetess of the century, Mrs. Browning, who knew from her own experience what the suffering of childbirth was, has thus described it:

"I appeal
To all who bear babes! In the hour
When the vail of the body we feel
Rent round us, while torments reveal
The motherhood's advent in power."

There might be added the words that Euripides has put in the mouth of Medea:

"Thrice would I stand on the rough edge of battle
Ere once bear the pangs of childbirth."

[2] Dr. T. G. Davis, Bridgeton, N. J., informs me that instead of a quilt he uses newspapers, more likely to be aseptic, and over them a sheet; the papers are readily had, absorb discharges well, and afterward are burned.

The expression used by old English writers, among others Lord Bolingbroke and Dean Swift, for lying-in was "being in the straw." Should the practice suggested prevail, there might be substituted "being in the newspapers," a condition to which not only many women, but also men, including some doctors, are not averse!

upon that part of the bed where the patient's hips rest, and secured by safety-pins. Rubber cloth now is placed so as completely to cover and protect the draw-sheet; next there may be laid upon the rubber a folded blanket, or comforter, and finally a sheet also folded. After the labor is over every article down to the draw-sheet is removed, and that is changed from day to day when it becomes soiled.

In some parts of the country it is customary to prepare a large muslin sac and half-fill it with bran, which is placed under the hips of the parturient, and readily absorbs all fluids that are discharged; it is removed after the labor.

When the patient lies down, in the second stage of labor, her chemise and nightdress should be drawn up above the hips, and a twice-folded sheet pinned around the latter; this is far preferable to the skirt which is often worn at such a time, for the latter is not so easily removed, and its removal almost inevitably causes some soiling of the lower limbs. A piece of old carpet or of oilcloth is spread on the floor at that side of the bed upon which the patient lies.

Management of the First Stage of Labor. During this stage, the presentation being normal, and the general condition good, the patient ought not to be in bed; sitting, walking, or standing is more favorable for the entrance of the head into the pelvic cavity than lying; moreover, if she is up now, the necessary confinement to the bed in the second stage of labor will be less irksome. She may be encouraged to engage in some light occupation or in cheerful conversation, so that the time will not drag, and her mind will in some degree be diverted from her suffering. Few persons should be in the room, and those only who are agreeable companions to her, and who will abstain from exciting her fears by the manifestation of great anxiety, by gloomy looks and untimely forebodings, or by narrating the misfortunes of other women in labor or in childbed. Her sympathies and her antipathies ought to be consulted in regard to those who are with her, and the obstetrician who knows how wisely to observe and judiciously to act can often regulate this matter to the great benefit of the patient.

Condition of Bladder and Rectum. If these organs have not been recently, and cannot be spontaneously, emptied, artificial means must be used. It very seldom happens that there is urinary retention, but accumulation of feces is common; the best means for the relief of the latter will be an enema of water, or of soap and water.

Food, Drink. Usually there is very little desire for food during labor, but if it be protracted the patient should take nourishment in some form lest she become exhausted; she may have any simple food she desires, care being taken that the stomach is not overloaded. The most grateful drink will be cold water, and that may be taken freely. On the other hand, hot teas, so often in the country urged in domestic practice upon the parturient by injudicious friends with the purpose of "making the pains stronger," as well as alcoholic stimulants, ought to be forbidden.

Active Interference with the Process of Dilatation. There is a notion[1] on the part of some women that the doctor can and

[1] Some years ago I saw a woman who had a torn cervix and perineum, and she explained her condition as resulting from the fact that "the doctor opened" her "up too much" when she gave birth to her child.

ought to render important assistance in the physiological processes of childbirth by mechanical or other means. Some doctors, too, advocate and pursue this practice. Dr. Barnes has justly characterized digital dilatation of the os uteri as "old and bad."

The danger of septic infection by manual dilatation, and by all unnecessary examinations, has been strongly presented by Spiegelberg in considering the prophylaxis of puerperal septicæmia: "Care must be taken that labor go on as simply as possible; manipulations in the genital passages are to be made only when absolutely necessary. . . . Nothing is more objectionable and more repulsive than the almost incessant exploring and manipulating in the vagina, the os uteri, and the vulva, which most midwives are in the habit of doing when the labor does not progress as rapidly as they desire. . . . The danger in this for the puerpera cannot be too strongly emphasized."

The young practitioner may be assured that digital dilatation of the as uteri, or of the os vulvæ, is rarely necessary; in most cases does no good, and in some may do much harm.

Among the other means resorted to for shortening the first stage of labor may be mentioned the administration of ipecacuanha in an emetic dose, a practice which was never common and which is now becoming almost unknown, and the application of belladonna to the cervix, or, as advised by Horton,[2] the injection of a solution of atropine into its substance. I can say nothing in favor of any of these means from personal experience, but in normal labor they are unnecessary.

It may be added that an 8–10 grain solution of cocain applied to the margin of a resisting or rigid os often proves useful.

Presence of the Physician. It is not advisable for the physician to remain constantly in the room during the first stage of labor; an occasional absence gives the patient an opportunity to evacuate the bladder, to make changes in her clothing, or attend to other matters which might be prevented by his presence. Further, if he constantly stays in the room she may anticipate a speedier termination of her labor than is possible, or she may think her condition serious; beside this, he may be appealed to by her or by her friends to render some supposed assistance, which may be very injudicious or even injurious. In many cases it is not necessary for him even to remain in the house, and he may take the opportunity to visit other patients; but it should always be known where he can be found, if any emergency arise demanding his immediate presence. A physician may exhaust his strength by too constant attendance and too assiduous attention during the first stage of labor, and by denying himself needed sleep, so that when some serious difficulty arises in the second or third stage he may lack the clear head, the firm hand, and the physical endurance upon which the salvation of his patient or of her child rests.

Management of the Second Stage of Labor. The uterine contractions are reinforced by voluntary efforts, and the first usually passes into the second stage of labor by a gradual transition. The patient now goes to bed, her clothing being arranged as has been mentioned; but if a primipara, or if the labor be slow, it is not necessary for her to

[1] American Journal of Obstetrics, 1878.

remain constantly lying down; occasional sitting up, or taking a few turns in the room, will give her some rest, and also may hasten delivery.

At the beginning of this stage the bag of waters usually ruptures; and it is not advisable to rupture it if the labor is progressing favorably. Should this be necessary simply pressing the finger against it during a uterine contraction will generally answer; if such pressure does not succeed, a few notches may be cut in the finger-nail[1] making a saw of it, which may then be thus used against the tense membranes. Immediately after the escape of the amnial liquor a vaginal examination must be made, in order to confirm, in some instances possibly to correct, the diagnosis of presentation and position that has been made, or to make this diagnosis if it has hitherto been impossible, and to ascertain any change of position, or any increase in descent of the presenting part, which in a multipara may sometimes become very rapid immediately after the evacuation of the fluid; so, too, this examination is now necessary, in order to ascertain whether prolapse of the cord, or of one of the upper or lower limbs, has occurred.

Position of the Patient. It varies in different countries, but with us she usually lies upon the back, or upon the left side. Until the head rests upon the pelvic floor the most favorable position during a pain is one between sitting and lying, the feet pressed against a firm object, or the bent knees fixed by the pressure of the hands of one of the attendants, the upper portion of the trunk drawn forward by the patient grasping the hands of the nurse or a sheet or towel fastened to the lower part of the bed for this purpose, and the chin turned to the chest. A kneeling[2] or squatting position is the most favorable for the expulsion of the child, but the child may be injured, the perineum cannot be protected, the liability to hemorrhage is greater, and it is impossible to manage properly the third stage of labor, as well as difficult to put the patient in bed. When lying upon the left side the usual right obliquity of the uterus is corrected, and in this regard the uterine force acts more advantageously; the abdominal pressure, however, is less, and the general force is directed too much in the direction of the axis of the inlet—that is, toward the fundus of the pelvic cylinder—whereas the line of exit for the fœtus is nearly at a right angle to that of entrance. Many women prefer the side position because of the relief to pain in the back which firm pressure of the hand upon the sacrum gives; such pressure, of course, cannot be made when the patient lies on her back. Schröder has proved that rupture of the perineum is more frequent in women delivered upon the back than in those delivered upon the side, and therefore the latter position should be taken in all cases in which there is danger of such rupture as soon as the head begins to press upon the pelvic floor. In this position, too, visual examination of the perineum, should it be necessary, is possible.

[1] It has been objected to this method that in these days when the obstetrician must have short finger-nails, to avoid furnishing a refuge for septic stuff, this cannot be done, and instruments have been invented for piercing the membranes—a matter of ingenuity to make and of money to buy! A bodkin, which can be found in every house, after disinfection, may be used, if the finger-nail is too short; or a probe or director from a pocket-case will answer.

[2] Kleinwächter.

Walcher's Position. A Venice physician, in 1738, advised the patient in labor to be placed horizontally on a table or bed, so that her lower limbs would hang over its edge. It has recently been claimed by Walcher that this position increases the true conjugate 8–13 mm.; Klein states that the increase is only 5–6 millimetres.

My friend and colleague, Dr. Forbes, assures me that such increase is very doubtful. Certainly the force thus resulting cannot be compared with that exerted by the wedge-like action of the fœtal head when driven or drawn through the pelvis. It is possible that Walcher's position will pass into oblivion, as did that of which it is merely the echo.

Condition of the Child. Occasional inquiry may be made of the patient as to her being conscious of the movements of the child. But a more certain way of learning its condition, either in the first or second stage of labor, is by auscultation. The first indication[1] of the suffering of the child is shown by a greater rapidity of the cardiac pulsations; then, if this state continues, to the acceleration which appears at first there succeeds a slowing, which becomes more and more decided as the fœtal life is more and more compromised. At the same time that these variations are observed and irregularities are produced, the intensity of the *bruits* lessens. Whenever, says Depaul, the cardiac pulsations fall below 100, and especially below 80, the condition is a very serious one, and if possible the accoucheur ought to intervene and end the labor.

Condition of the Os Uteri. As has been stated, the rule is that in the first stage of labor attempts to dilate the os uteri by the fingers should not be made; so, too, they are usually not required in the second stage. But as it sometimes happens that in the former the force of the uterine contractions is in part lost in consequence of the os being directed too far posteriorly and to the side, and it may be then advantageous to hook the fingers into the os during the absence of a pain, and draw it toward the centre of the pelvic cavity, keeping it in this position during a contraction, so in the second stage the anterior margin of the os may be found closely applied to the fœtal head, while the posterior has receded, hence liberation of the former is indicated. The part of the fœtal head in front descends at each contraction, hooded by the anterior portion of the dilated cervix, and this portion thus compressed between the head of the fœtus and the pelvic wall is liable to become swelled and œdematous. Therefore, by the advice of the most conservative obstetricians, this part may be pressed up, in the intervals of contractions, by one or two fingers, and thus held during a uterine effort; sometimes the head immediately passes the obstruction, but in others it may be necessary once or oftener to repeat the proceeding. Let it be remembered that this manœuvre, which is seldom necessary, must be done without violence.

Cramps in the Lower Limbs. Cramps affecting the thighs or legs sometimes cause great suffering; they occur in the second rather than in the first stage of labor, and are attributed to pressure and dragging upon certain nerves of the pelvis, branches of the sacral plexus, the sciatic, the obturator, etc. Rubbing the affected part with the hand, change of position, or the use of an anæsthetic will give relief.

[1] Depaul, op. cit.

Food, Drink, etc. Preparation for Delivery. Unless the second stage be unusually long the patient rarely desires or needs nourishment; a full stomach will hinder the needed voluntary effort during a uterine contraction; if food is given, only a small quantity is advisable, and it should be simple and easily digested. Now, as then, cold water may be taken as desired. Frequently bathing the patient's hands and face with cool water will in most cases be both agreeable and refreshing.

When the second stage approaches its end, hot and cold water, an alcoholic stimulant, scissors, and a string for tying the cord are to be at hand.

Pressure of the head upon the rectum often causes a factitious desire to empty the bowels, and the patient insists upon getting up for this purpose; but she must be refused, for the child might be born while she was on the commode or in the water-closet.

Care of the Perineum. Usually the most important of the obstetrician's active duties in the second stage of labor is protection of the perineum from being torn during the delivery of the head and shoulders of the fœtus, or, if a tear is inevitable, cause that to be as slight as possible.

Matthews Duncan and Schröder have shown that in primiparæ some tearing of the vaginal orifice is inevitable, and the rent may involve the perineum, only 39 per cent., according to the latter, escaping rupture of the fourchette. Not only injury of the posterior portion of the vulva, but also of its anterior may occur, and the rents in some cases cause serious hemorrhage. The perineum is especially liable to tear from the direction of the force which propels the child through the birth-canal; it is a resisting wall designed to direct the fœtus toward the opening in the anterior portion of the dynamic pelvis. When the perineum gives way the rent generally occurs in the median line, for there the distention is greatest and the tissues are furthest from their points of attachment. Even if the perineum receives no injury immediately apparent, it may have been subjected to pressure for so long a time and been so greatly stretched that, though entire for some days after delivery, it finally gives way, and the condition is then similar to laceration. Hibberd[1] has reported two cases of the kind, and Duncan[2] previously directed attention to the fact, but a case of such injury was first described by Dewees.[3]

Frequency of Ruptures of the Perineum. Taking hospital statistics rather than any derived from private practice, it is probable that the perineum is more or less torn in 20 to 30 per cent. of primiparæ, and in 5 to 10 per cent. of multiparæ.

Causes. Without referring to special conditions of the parts creating a liability to the accident, or the form of the pelvis, or certain presentations and positions, it may be in general stated that the great majority of perineal tears occur from too rapid deliveries, the child being expelled before there is sufficient dilatation of the vulvo-vaginal opening; the force is too great, and the time too short, so that soft parts are not stretched but ruptured.

[1] American Practitioner, 1881. [2] Papers on the Female Perineum, 1879.
[3] System of Midwifery, eighth edition, p. 287, 1837.

Prevention. It follows from the statement just made that, to prevent a tear of the perineum, or to make the tear as slight as possible if some injury be inevitable, the most important means are to hinder abrupt expulsion of the fœtus, and to promote gradual dilatation of the part it traverses. In attaining these objects one of the first things to be done is to have the patient lie upon her side, preferably the left side. The advantages of the lateral position are lessened voluntary effort, preventing the wide separation of the thighs, and in this position the condition of the perineum may be known, if necessary, by actual inspection. There must be no pressure against her knees, and any object against which her feet may push should be removed; she should be directed to take frequent respirations, and to refrain from all bearing-down efforts; if such efforts cannot be thus prevented, chloroform may be given. A doubled pillow or a quilt made into a roll is placed between her knees. If the dilatation of the vulval opening be insufficient, the head must be held back by direct pressure, and, when it is finally expelled, it should be guided during the expulsion in the axis of the opening. Hohl directed grasping the head, after the occiput has passed under the pubic joint, with the hand, the thumb above, the fingers below reaching to the anterior margin of the perineum, and thus holding the head back during a pain. Others apply pressure to the head with one hand, while the other is used to support the perineum.[1]

Supporting the perineum is, as Matthews Duncan has remarked, a practice upheld by the majority of obstetricians, both now and in past times.

In many cases the condition of the perineum as to ready dilatability is such, the expulsive force acts so regularly and moderately, and the relation of the object to be expelled is so adapted to the outlet of the birth-canal, that there is no danger of injury, and therefore no effort should be made to support it; the obstetrician's only duty then is to receive in his hand the head of the child as it is expelled. But in other cases the following plan may be followed: Supposing the patient to be lying upon her left side, and her hips quite near the edge of the bed, the practitioner places his right hand so that the concave palm receives the convexity formed by the bulging perineum; the thumb is upon the right, and the four fingers upon the left labium majus, while the fold between the thumb and index finger corresponds with the anterior margin of the perineum. Moderate resistance is made to the force driving the head against the perineum, and at the same time the head is gently pressed toward the pubic symphysis; strong pressure is to be avoided, because if the perineum be very thin, such pressure at this thinned part may cause a central tear. No napkin should be interposed between the hand and the perineum; the hand is not applied until perineal distention begins, and the application is only during a pain. The left hand is passed over the patient's upper thigh, and grasps the fœtal head in the manner directed by Hohl, holding it back when necessary, and at the proper time guiding its exit in the axis of the vulval orifice.

[1] In the first edition I gave various means for saving the perineum advised by different authorities—Siebold, Bernati, Ritgen, Smellie, Goodell, Reamy, Price, and others.

A clearer understanding of the mechanism of perineal tears, and of their prevention, will be had by examining the subjoined diagram taken from Varnier, and in connection with it the suboccipital diameters as shown in Fig. 93. In Fig. 136 it will be seen that the parietal protuberances have just cleared, or are about clearing, the vulval ring, and that the suboccipito-bregmatic diameter lies directly antero-posteriorly. But in order that the head may be born a longer diameter, and consequently a larger circumference, must be in relation with the ring; this change, as has hitherto been generally taught, occurs by a partial rotation of the head, the beginning of deflection, or as taught by Berry Hart—his views will be more fully presented in a moment—by a progression, and thus there is not even the least deflection of the head, no pivoting of a fixed point of the nucha upon the pubic joint. But without reference to either view just given, the danger of perineal rup-

Fig. 136

Head about to Pass the Vulval Opening.

ture comes with the rapid advance of the head before retraction of the perineum can occur, for the perineum does not need to be elongated at this stage—elongation means delay or rupture, length is not required, but breadth; its own elasticity determines retraction, and in the retraction diminished length gives increased breadth. By moderating abdominal and uterine action, and by retarding the abrupt exit of the head, letting the perineum withdraw from the head rather than the latter advance from the former, we best preserve it from injury. If this view be correct, then many of the methods advised for protecting the perineum are useless, and some are most unnatural and mischievous, proceedings that thwart rather than assist nature's method. Give the perineum time to draw back when the greatest strain upon the vulval opening comes, and it can be better protected than in any other way.

Support of the perineum must be continued during the passage of the shoulders lest a new rent be made, or a slight one caused by the expulsion of the head be increased.

Hart denies[1] that the chin leaves the sternum while passing the perineum, and that during the anterior fixation of the occiput under the pubic arch antero-posterior and increasing diameters of the fœtal head form the antero-posterior diameters of the girdle of resistance. His method of "protecting the perineum from undue tear" is this: "All the attendant can do, apart from the familiar means of relaxing perineal spasm by chloroform and hot applications, is to prevent the sinciput being forced down in advance of or faster than the occiput. He restrains the fœtal head from passing too rapidly. He thus has always to get the occiput to lead, and to get it fully born if possible. So far as I can judge, the best way of doing this is as follows: With the patient lying, of course, upon her left side, the attendant places the thumb of his right hand, guarded by a napkin soaked in hot sublimate, in front of the anus and presses it gently there. The pressure is not in the direction of a line joining his thumb and the pubic arch, but nearly in that of the pelvic outlet. By this, descent of the sinciput is hindered, and that of the occiput favored. When the latter is beginning to pass under the pubic arch the fingers of the same hand are placed between it and the apex of the arch, so that when the occiput has cleared the arch the fingers are passed toward the nape of the neck, and the head thus grasped in the hand, the thumb lying over the sagittal suture. This gives one complete command over the head which is now engaging in the diameters between the nape of the neck, and forehead and face, and allows the whole passage with as little tear as possible."

EPISIOTOMY. If a serious tear of the perineum seems inevitable, many advise that an incision or incisions be made to prevent this accident. This practice, though generally credited to Michaelis, 1810, was recommended by Ould[2] 1742.

Opinions differ as to the necessity for incisions, and also on the part of those who approve of the operation as to where they should be made. The late Dr. A. H. McClintock stated that he had so often seen the perineum escape laceration, where this accident seemed inevitable, he was led to doubt the possibility of recognizing the cases in which incision is an absolute necessity. Playfair asserts that when a distended perineum ruptures its structures are so thinned that the tear is always linear; and, as a matter of fact, the edges of the wound are always as clean and as closely in apposition as if the cut had been made with a knife. This statement may be received with some doubt, even by those who have never examined a recent tear of the perineum.

The incisions usually recommended are lateral. Tarnier, however, states that they do not always prevent even quite extensive tears, and they may leave deformity and a painful cicatrix, or the duct of one of the vulvo-vaginal glands may be divided and a fistula result. He therefore advises an incision of the perineum, beginning at the raphe, and then not passing directly back, but turning obliquely to one side, so that if a laceration follow, it cannot involve the same sphincter. He cautions against episiotomy, unless it is quite indispensable, for

[1] Edinburgh Obstetrical Society's Transactions, vol. xii. It must be conceded that extension is impossible while the perineal band is stretched over the frontal bone—that band must hold the chin upon the sternum; but once the forehead clears the perineal margin, or, which amounts to the same thing, the perineum retracts over the forehead, extension can begin—very slight indeed at first, but increasing until the head completely emerges, its perfect delivery being followed by a dropping down of the head, a return of partial flexion, which would be impossible if there had not been some extension.

[2] "It sometimes happens, though the Labour has succeeded so well that the Head of the Child has made its Way through the Bones of the Pelvis, that it cannot however come forward, by reason of the Extraordinary Constriction of the external Orifice of the Vagina; so that the Head, after it has passed the Bones, thrusts the Flesh and Integuments before it, as if it were contained in a Purse; in which Condition, if it continues long, the Labour will become dangerous, by the Orifice of the Womb contracting about the Child's Neck; wherefore it must be dilated if possible by the Fingers, and forced over the Child's Head; if this cannot be accomplished, there must be an Incision made toward the Anus with a Pair of crooked Probe-Sizars; introducing one Blade between the Head and Vagina, as far as shall be thought necessary for the present Purpose, and the Business is done at one Pinch, by which the whole Body will easily come forth."—A Treatise on Midwifery. By Fielding Ould, Man-Midwife. Dublin, 1742. Ould also advised stitching the wound if the incision be made so near the "Rectum as to weaken its Contraction."

he has sometimes seen the incised parts covered with eschars, and become the medium of grave infectious accidents.

Delore, in referring to the lateral incisions advised by Dubois, states that he accepts in extreme cases this slight operation, but in ordinary cases it is preferable to have a median rent, which cicatrizes uniformly, than two lateral ones, which result in deformed cicatrices.

It may be stated that episiotomy will very seldom be plainly indicated, and in private practice will rarely be done.

Dr. Broomall[1] regards episiotomy as a safe and justifiable procedure when the perineum is threatened, and where the danger of deep laceration is evident, as the proper and indispensable means to be used with the hope of meeting that danger. She advises a probe-pointed curved bistoury to be used; the blade is slipped between the fœtal head and the lateral margin of the vaginal orifice, and its cutting-edge directed during a pain toward the tuber ischii; the incision is made at a point one-third the distance from the posterior commissure to the clitoris; the length of the incision never exceeded 1.5 centimetres. A similar incision is made, if necessary, at the opposite side; after the labor, the edges of the wounds are united by silk sutures. Dr. Manton[2] strongly advocates episiotomy, claiming that it diminishes the frequency of perineal ruptures to a minimum. He also operates with a probe-pointed bistoury, and makes an incision from 1 to 3 centimetres long, first on one, and then, if necessary, on the other side; he thinks it better not to include the external skin in the incision, although no harm is done should this be done.

Delivery of the Shoulders. Immediately after the head is expelled and rests in the hand of the accoucheur a finger is passed to the neck of the child to find if the cord encircles it, an accident occurring once in five cases; if this be the case, the loop must be enlarged, and an attempt made to draw it over the head; if this fails, the shoulders are to be delivered through the loop. In some cases the cord encircles the neck not only once but even three or four times, and the coils may be so tight that dividing the cord is necessary; if this be done, it is advisable, unless the fœtus is immediately delivered, to tie the fœtal end of the severed cord.

Moderate pressure is made upon the patient's abdomen during the expulsion of the body, the hand so placed that it "follows down" the uterus as it descends, with the discharge of its contents, in the abdominal cavity. The shoulders are usually delivered soon after the head; any delay can generally be remedied by moderate manual pressure or friction of the uterus through the abdominal wall; it may be advisable in some cases to turn the head of the fœtus with the occiput toward the mother's left or right thigh, according as the position was left occipital or right occipital, thus having the external rotation of the head invite and correspond with the internal rotation of the shoulders; then let the head, still held in the hand, drop down so that slight traction is exercised upon the anterior shoulder, which may be thus liberated. After the anterior shoulder comes in the pubic arch the head is to be carried up toward the mons veneris, slight traction being made, when the posterior shoulder will be delivered; the injunction is repeated, during the delivery care must be taken that the perineum escapes injury.

Difficult Delivery of the Shoulders. In some cases, however, the delivery of the shoulders cannot be thus accomplished; the body is very large, and the fœtal circumference of the shoulders and chest much greater than usual,

[1] American Journal of Obstetrics, 1878. [2] Ibid, 1885.

while the *vis a tergo*, the uterine and abdominal contraction, may fail. The difficulty may be increased by the child's breathing, for thereby the circumference of the chest is increased. Danger comes to the child from compression of the chest, or of the cord, which may encircle the body, and death is inevitable unless speedy delivery can be effected. One of the ways which may be quickly tried is to exert traction with the hands applied to the sides of the child's head. Even if we cannot complete the delivery of the shoulders in this way, we may advance it so far that a finger can be readily introduced into the axilla of the perineal shoulder, and then pull with this finger; or traction may be made with the fingers in each axilla. Jacquemier, who gave special study to this difficulty in labor, and found that in 26 cases 20 of the children died,[1] advised bringing down the arms, upon which traction can be made, and beside, when they are disengaged the size of the chest is lessened. Although the practice is indorsed by Charpentier, he acknowledges that in one case he fractured the humerus: if there be room for this manipulation, there is room, as Spiegelberg taught, for delivery by other methods, and it may be rejected. Hodge advised pushing the anterior shoulder in behind the pubic joint, then bringing the neck of the child in the pubic arch, so that its side presses against the subpubic ligament; by this means the posterior shoulder is brought to the margin of the perineum; when such change has been effected the head is carried backward and the anterior shoulder again comes just outside the pubic arch, and delivery is usually easily effected. This plan was also advised by Spiegelberg. Occasionally it may be necessary to use a blunt hook, instead of the finger, to exert traction from the axilla; one must be careful, however, not to act upon the humerus on account of risk of detachment of the epiphysis; after either traction by finger or blunt hook temporary paralysis of the arm may occur. Of course, the patient should be urged to "bear down," and uterine action stimulated by friction and assisted by external abdominal pressure.

Delivery of the Rest of the Body. After the delivery of the shoulders the remaining portion of the body is in general very promptly expelled; but if it is not, and immediate delivery is necessary, the hands should grasp the thorax, and with gentle traction the process is completed. It is very much better, however, in most cases, to trust the expulsion of the child to the uterus.

Attention to the Child. The child is laid upon the bed at the side, not so near that by any sudden movement it may roll off, and not so far from the mother that there is any dragging upon the cord; it is placed where it can get air, and in a position in which it will not be bathed in the fluids that often make a pool about the mother's hips. It usually at once breathes freely and cries vigorously; if respiration be hindered by accumulation of mucus in its mouth, the secretion must be wiped away by the finger covered with a little soft muslin. In case respiratory efforts are feeble or absent, they generally may be quickened or excited by dashing one or two teaspoonfuls of cold water upon the chest, or friction of the chest may be made by the obstetrician with one of his hands upon which a small quantity of spirits of camphor has been poured.

It was the custom of Mauriceau, Clement, La Motte, and Deventer, indeed, of the old[2] obstetricians generally, not to tie the cord until the placenta was expelled; Zweifel has revived this practice, and he uses

[1] I have met with this hindrance to delivery in three cases in which the child could not be extracted soon enough to prevent death. The method advised by Hodge and Spiegelberg I think the best. In some instances the delivery is impossible until the size of the chest is lessened.

[2] Denman, without reference to the expulsion of the placenta, stated that "the navel-string of a newborn infant ought not be tied or divided till the circulation in it has ceased spontaneously."

but a single ligature. Most obstetricians, however, are in the habit of ligating the cord as soon as the child breathes freely.

Some experiments, made by Budin[1] in 1875, in immediate and late ligation of the cord, proved that when the latter plan was followed the infant received a large quantity of blood, the average was 92 grammes, and thus immediate ligation deprived the infant of this. In March, 1885, he stated that almost all contributions to the subject, published in different countries, confirm the general conclusion which he had previously reached, viz., ligation and section of the cord should not be done until after complete cessation of the vascular pulsations of the cord. Not merely is the child by late ligation secured a notable amount of blood otherwise left in the placenta, but its subsequent condition is more favorable, it loses less weight in the first days following birth, and acquires weight more rapidly than a child in whose case immediate ligation was done. These were the conclusions not only of Budin, but also of Ribemont, Schücking, Zweifel, and of most who investigated the subject. The matter has been studied anew by Engel.[2] He observed that the pulsations in the cord continue for some minutes, or even for a quarter of an hour, after birth. He found that late ligation secured to infants born at term 70 grammes, but to premature infants 90 grammes. Engel failed to discover any relation between loss of weight in the first days after birth, but his statistics prove that late ligation secures increased vitality to the infants. Thus the mortality of premature infants when immediate ligation was done was 18.88 per cent. but with late ligation only 9.45 per cent. The reserve blood which the fœtus obtains in late ligation has been explained as entering partly through thoracic aspiration and partly through pressure upon the placenta while it is squeezed out of the uterus. But Cariglia[3] has proved that respiration has no effect in this process, and it is therefore solely due to the pressure mentioned.

In regard to waiting until all pulsation has ceased, one might, in some cases, wait until all patience as well as pulsation had ceased; for example, La Motte[4] mentions going to a woman who had been delivered *trois grosses heures* before his arrival; the child was lying between the mother's thighs, the placenta undelivered, and "the beating of the cord was of a marvellous force."

It is not necessary nor advisable to make an absolute rule that pulsation must cease before tying; when the child cries vigorously, breathes freely, and the pulsation lessens in force, one usually need not wait.

Various material has been used for tying the cord. The late Dr. Bedford preferred tape, believing that if a round string was used the child was more liable to trismus. Dickson[5] first advised the elastic ligature, and Tarnier uses it in addition to the ordinary one. A few strands of hemp thread answer the purpose very well; but my preference is for the Chinese silk used in tying the pedicle in ovariotomy, for it is strong, and a tight knot can be made without any danger of either cutting the cord or the obstetrician's fingers. Whatever is used, it ought not to be so thin as to risk cutting the cord, or cutting the physician's fingers when he is drawing the knot. The ligature is placed about three fingers' breadth from the umbilicus; the string or tape is passed under the cord, the ends brought above and tied, gradually and firmly compressing the cord so as to force away at the place of constriction the gelatinous portion, with a surgeon's knot and then a single knot.[6] In

[1] Obstétrique et Gynécologie, Paris, 1886.
[2] Centralblatt für Gynäkol., 1885.
[3] Gazet. deg. Hosp., 1892.
[4] Observation ccxxx.
[5] Proceedings of Edinburgh Obstetrical Society, January 14, 1874.
[6] It is generally recommended that a second ligation of the cord be made, partly upon the ground that thereby the clothing is protected from the soiling caused by escape of blood from the placental end of the funis, and chiefly because it was believed that if this escaping blood was retained in the placenta, the detachment of the latter occurred more promptly. But Budin and

plural pregnancy a second ligature is required because of the possible vascular connection between the circulation of the two fœtuses in the placenta. After ligation the cord is divided, care being taken to leave a large button-like projection at the fœtal portion, so that the ligature cannot slip off; blunt-ended scissors are best for making this section, and the obstetrician must be watchful lest a finger or some other part of the fœtus be included with the cord between the blades. After the section press a soft rag upon the cut surface to dry it, and then watch for a minute or two to see if there be any oozing of blood; if there be, another ligature must be immediately applied.

The obstetrician now hands the child to the nurse, who has a small blanket or shawl, which has been warmed for its reception. In handing it to her he either places the right hand under the shoulders, the thumb and index finger supporting the head, and the left hand holding the ankles; or, as taught by Dr. Hodge, he embraces the thorax of the infant with the right hand extended so that the palm is over the sternum, the thumb under the right axilla, and the fingers under the left, and the head falls toward the sternum; this is a natural position for the child, the practitioner has a firm hold, and the left hand is left free for any required assistance. Trivial as these directions may seem to the student, yet in practice he will find that attention to the little things has much to do with the obstetrician's success.

Washing the Child and Dressing the Cord. Though washing the infant and dressing the cord are usually done by the nurse, yet occasionally one or both of these duties may devolve upon the doctor, and even if this be not the case, he ought to know how they are best done. There are needed for the washing a soft sponge, a piece of old linen or cotton cloth, water at a temperature of 100° F., some oily substance, such as unsalted butter, lard, sweet oil, or vaseline—or, instead of any of these, the yelk of a fresh egg—and Castile or some one of the finer soaps; transparent glycerin soap is good. The oily matter, or the egg-yelk, is used for the purpose of facilitating the removal of the *vernix caseosa*, and the body of the child is first rubbed with one of these substances. The face is now washed with warm water simply, no soap being used, lest some of the soapy water should get into the infant's eyes, causing pain, and possibly a conjunctival irritation which may result in inflammation; children of a larger growth will strenuously object to soap-water for washing their eyes, and let the infant be treated as kindly. After washing and drying the face, the body and limbs are washed with soap and water, and well dried; the washing of course must be done in a warm room, quickly, avoiding prolonged or unnecessary exposure of the child, and with gentleness, care being taken not to irritate the sensitive skin by rude rubbing, even though some portion of the *vernix caseosa* may remain, for it will dry up in a day or two, and be spontaneously detached, or can be removed at a subsequent washing. After drying the infant, powdered starch is dusted over the surface, especially at the flexures of the knees, thighs, and elbows, and in the axillæ.

Ribemont-Dessaignes have experimentally proved that the blood escaping from the placental end of the cord, in lessening the volume of the placenta, facilitates its separation, permitting uterine retraction which little by little reduces the surface of placental attachment. Unless, then, in cases of plural pregnancy a single ligation is advisable.

If the mother has had a purulent vaginal discharge, even if there is any suspicion of her having had a specific vaginitis, the child's eyes having been first carefully washed with warm water, should have applied to them a drop or two of a 2-grain solution of nitrate of silver.

The common method of dressing the cord is this: A square piece of old linen, a little more than twice the length of the attached cord, is slightly scorched, a hole cut in its centre, and mutton suet put upon its under surface; the cord is passed through the hole, then the linen folded first transversely, and afterward from side to side, over the cord so that the latter is completely wrapped. Iodoform or creolin gauze may be used for wrapping the cord, absorbent cotton or cotton-wool is objectionable because the drying of the cord cannot, when thus covered, occur so readily. Goodell advised squeezing out Wharton's jelly from the cord, and this certainly seems to me best. When the duty of caring for the cord devolves upon the practitioner, he may pursue the following plan: Let him take a piece of soft cotton rag, place it upon the cord, and grasp the latter just below where it has been tied with the thumb and fingers of the left hand; now cut off the cord at the point of ligation, and then squeeze out all of Wharton's jelly upon the rag, and in a minute or two the cord is reduced to half its former size, and, instead of being a solid cylinder, is a limp, ribbon-like body. A new ligature is now applied, and bleeding is impossible. A little iodoform, or a powder of starch and salicylic acid, may be sprinkled upon the stump of the cord, and then it may be encircled with a few turns of a linen or muslin bandage, an inch to an inch and a half in width, which is fastened by a silk or hemp thread; no subsequent dressing is needed; the cord and bandage will fall off together in a few days. The advantages of this plan are the comfort of the child, absolute security from hemorrhage, and the lessened mass to be detached.

Dressing the Child. The "belly-band," which is almost universally used, should not be tight, for the increase in pulmonary capacity in the newborn is chiefly due to descent of the diaphragm, and the bandage must be sufficiently loose to permit this increase; a bandage that is loose immediately after birth may often after a few hours cause injurious compression; it will be the duty of the obstetrician to see that no mistake is made in this matter. The fewer pins used in fastening the clothing of the infant the better, and as far as possible tapes should replace them.

Apparent Death of the Newborn. The child born apparently dead does not cry, does not breathe, or only at long intervals gives a faint gasp, there is absence of reflex movements, but pulsations of the heart still occur, though they are very weak. The most frequent cause is asphyxia, and this asphyxia may result from compression of the cord, for example, in prolapse, or from coils about the child's body, or in head-last labor Further, the asphyxia may be caused by premature separation of the placenta, or from continuous uterine contraction, or from the mother's blood failing to furnish oxygen to that of the child, as in grave hemorrhage, eclampsia, and various diseases which cause accumulation of carbonic acid in her blood. The child in utero threatened with apparent death may have a discharge of meconium, and the

discovery of this excretion in the amnial liquor during labor when the pelvis does not present justly awakens suspicion of peril, though frequently this accident occurs and birth of a perfectly healthy child follows. More important is the condition of the pulsations of the fœtal heart as indicating asphyxia; these either are greatly increased in frequency or fall below the normal—in each case they become feeble, less distinct. The failure of placental respiration, the fœtus being thus threatened with asphyxia, causes in many cases the effort at pulmonary respiration, and hence there may be drawn into the air-passages amnial liquor, mucus, blood, etc., aggravating the original affection and making the treatment more difficult. In apparent death from asphyxia the color is almost purple; the features, especially the lips, swelled; the cord is large and full of blood; the limbs are not flaccid, but even may be somewhat rigid. It has been described as blue asphyxia, and sometimes, too, spoken of as apoplectic. A rarer form of failure of respiration in the newborn has been called pale asphyxia. The child's surface is remarkably white; the limbs limp and relaxed; the cord small, thin, apparently almost bloodless. The condition is very much more unfavorable than that previously described. It has been called syncope, and probably that is the best designation. Its origin seems to be most frequently pressure upon the brain, and is oftenest observed after labor in case of a contracted pelvis, or after the application of the forceps; intra-cranial hemorrhage may be present instead of hyperæmia, and then recovery, if recovery occurs, is very slow. Depaul has spoken of pale asphyxia occurring in premature birth, and also in case of want of nourishment from disease of the placenta, for certain changes in this organ may produce a progressive inanition which does not kill, but the child is born thin, emaciated, and feeble.

Treatment. Division of the cord is made at once, but in pale asphyxia Depaul advises pressing toward the child's body all the even scanty supply of blood in the cord before cutting it; and it has been the custom in blue asphyxia to let a teaspoonful of blood escape from the fœtal end before ligating, though now most authorities assert this is useless. I have often done it, still do it, and am glad to find that Winckel approves the practice. Immediately after separating the child from the mother the mouth and fauces are cleansed of mucus by means of the little finger wrapped with mull, and also the nares with a feather (Ahlfeld). It may then be put in a hot bath, and while lying supported by the obstetrician a little cold water thrown upon the exposed breast. If respiration still fails to be made after two or three minutes, other means must be employed. Faradization of the phrenic nerves has been successful, but the means for employing this are rarely at hand. Artificial respiration comes next. The readiest way of effecting this is by the Sylvester method: The infant has hot, dry flannel applied to it, is placed upon its back, the head slightly raised by a small pillow, then the arms are raised and brought by the sides of the child's head, then to the sides of the child's chest; these alternate movements—one promoting inspiration, the other expiration—are continued for a few minutes. The removal of mucus from the air-passages is in some cases of essential importance. This removal may be effected

by the position of the child, as will be explained in describing Schultze's method of resuscitation, by introducing a flexible rubber catheter in the trachea and sucking out fluids, or by means of Ribemont-Dessaignes' instrument, probably the best of aspirators and insufflators; the laryngeal tube of Depaul may be used in a similar manner to that of the rubber catheter. The instrument of Ribemont-Dessaignes consists of a laryngeal tube and of a pear-shaped rubber bulb, readily attached and removed from the tube. To introduce the tube, let the child be

Fig. 137.

Insufflator of Ribemont-Dessaignes.

upon the back, its head supported by a pillow; the index finger is introduced in the child's mouth and directed so that its pulp touches the arytenoid cartilages, and then the tube is guided by it into the larynx; thence it is gently buried in the trachea and brought to the median line. For the removal of secretions that have entered the air-passages, let the compressed bulb be applied to the tube, and upon removing the compression the fluids are promptly aspirated. Remove the bulb, and, having its opening dependent, press it so that everything escapes from it. Next filled with air, it is applied to the tube, and gentle compression drives this air into the lungs. The insufflations may be practised once in eight or ten seconds. If respiratory movements are made, the period intervening between insufflations is lengthened. Artificial respiration should be employed as long as the heart continues to beat. Ribemont-Dessaignes, after describing his instrument and its application, says that it is sometimes not until the end of half an hour, or even three-quarters, that the infant makes the first respiratory movements, and it may not be until the end of an hour or more it first cries.

French obstetricians are partial to the means previously mentioned, while by most German authorities "Schultze's swinging" is generally regarded as the most valuable means of resuscitation. This is done as follows: The operator stands with his lower limbs somewhat widely apart, and his body slightly inclined forward, the arms and forearms extended. The infant is now held, its anterior plane in front, by the index finger of each hand entering the axillæ from behind, thumbs supporting the face laterally, and their ends resting upon the upper and anterior part of the thorax. This is the position of inspiration. After a moment the operator very quickly raises his arms until they pass the horizontal line and become oblique with reference to his body, and the child is made to revolve upon the index fingers as an axis, so that its

head is now lowest, and its hips highest, its lower limbs falling upon the anterior aspect of the body which is directly before the operator's face; the child's weight in this position rests upon his thumbs, which are placed upon the anterior face of the thorax. If this movement of partial revolution be made too rapidly, the child's back is bent too much in the dorsal vertebræ, whereas it is designed the bending shall occur in the lumbar vertebræ. While the head is in the dependent position the movement of expiration occurs, and any fluids that may have entered the air-passages flow out. The operator now lowers his arms, swinging the child back into the first position, when all pressure of the thumbs upon the chest is relaxed so that they may give no impediment to inspiration. These movements are repeated at suitable intervals.

Ahlfeld, after mentioning several accidents that have occurred from the "swinging," such as pulmonary hemorrhage, hemorrhage in the supra-renal capsules and into the abdominal cavity, rupture of the liver and of an enlarged spleen, fracture of the ribs, states that the method is not to be recommended for employment by the unskilled, consequently by most midwives.

In Forrest's method[1] of artificial respiration the child, after being turned upon its abdomen, the head lower than the pelvis, and pressure made upon the back to cause escape of any fluid that has entered the mouth and trachea, is placed in a sitting position in a bucket half-full of hot water, "the water being just above the infant's heart." The arms of the child are carried upward and a little backward by the operator's left hand, until the weight of the body comes upon the shoulders. The operator takes an inspiration bending forward, applies his mouth to that of the child, and "blows the air directly in the lungs." Expiration is made by doubling the child's body forward upon itself, its arms brought to the sides, and pressure downward and backward made upon the chest anteriorly. Dr. Forrest states that "artificial respiratory movements should be made at the rate of forty per minute, instead of twenty, as usually taught."

Winckel says that this method is "not sufficiently energetic for severe cases." Moreover, it is amenable to the just objection to all modes of mouth-to-mouth insufflation, that it is probable tuberculous disease may thereby be communicated, as the facts of Reich, quoted by Kältenbach, go far toward showing. Directly breathing into an infant's lungs ought not to be admitted as a common way of resuscitation.

Dew's[2] method is this: "Grasp the infant with the left hand, allowing the neck to rest between the thumb and forefinger, the head falling over backward, straightening the mouth with the larynx and trachea, thereby serving to raise and hold open the epiglottis; the upper portion of the back and the scapulæ resting in the palm of the hand, the other three fingers to be inserted in the axilla of the baby's left arm, raising it upward and outward.

"Then, with the right hand, if the baby is large and heavy, grasp the knees in such a way as to hold them with the right knee resting between the thumb and forefinger, the left between the fore and middle fingers. This position will allow the back and the thighs to rest in the palm of the operator's hand. If the infant is small and light, it will be found more convenient and easier to hold it in the same way by the ankles instead of the knees, allowing the calves instead of the thighs to rest in the palm of the hand.

"The next step is to depress the pelvis and lower extremities, so as to allow the abdominal organs to drag the diaphragm downward, and with the left hand to bend gently the dorsal region of the spine backward. This enlarges the thoracic cavity and produces inspiration.

"Then, to excite expiration, reverse the movement, bringing the head, shoulders, and chest forward, closing the ribs upon each other, and at the same moment bring forward the thighs, resting them upon the abdomen. This movement arches the lumbar region backward, and so bends the child upon itself as to

[1] New York Medical Record, 1892.
[2] New York Medical Record, March, 1893.

crowd together the contents of the thoracic and abdominal cavities, resulting in a most complete and forcible expiration. While this movement is a powerful one, the operator can, by his manipulations, accomplish it without shock and render it as gentle as he pleases."

Attentions to the Mother. Immediately after the birth of the child the mother is placed upon her back, if she was delivered lying upon her side, with but a single pillow, or only the bolster under her head. From the time of the birth the hand of the assistant, which was placed upon the uterus, following it down during the expulsion of the child, is kept there until replaced by that of the obstetrician. It must be borne in mind that the hand is applied, not flat, but with the fingers and thumb so flexed that a concave surface is formed corresponding with the convexity of the uterus, and that the purpose of this normal application is to assist uniform uterine retraction, thus securing early delivery of the placenta, and guarding against hemorrhage. It is the custom of some practitioners to administer from a half to a teaspoonful of fluid extract of ergot immediately after the birth of the child, while others defer it until after the delivery of the placenta, and still others omit its use altogether in physiological conditions. Ergot given after the removal of the placenta probably cannot interfere in any way with normal processes; it certainly is one of the most important means in prophylaxis of post-partum hemorrhage, and possibly it assists uterine involution. But unless there are plain indications, it is better to omit it.

Placental Expulsion. The delivery of the placenta is one of the most important of the accoucheur's duties. The patient is anxious until this final act in the drama ends; she cannot have the soiled clothes removed from her person and from the bed, nor parts that have been bruised bathed, nor secure that repose which her exhausted condition needs; a delay is sometimes the source of fear to her at least, according to the popular expression, that "the after-birth has grown fast to her side." Therefore it is unwise, so far as her immediate comfort is concerned, to do as practitioners in ancient times did, leave the delivery of the placenta to nature, pursuing a merely expectant treatment. The time of the practitioner also gives an argument against expectation. He cannot wait hours at the bedside, as would be necessary in some cases for nature to expel the placenta, when a little manipulation on his part, simply assisting nature, will accomplish this delivery in a few minutes. The following table of 100 cases in which the delivery of the placenta was left to nature is given by Kabierske:[1]

24 times	30 minutes.	5 times	5 hours.
20 "	1 hour.	3 "	6 "
25 "	2 hours.	2 "	8 "
11 "	3 "	1 time	12 "
9 "	4 "		

These figures are conclusive against trusting to purely spontaneous delivery of the placenta. The method more or less closely followed by most obstetricians is known as that of Credé, and briefly stated is this: Frictions, at first gentle and then more or less vigorous, of the fundus and of the body of the uterus are made through the abdominal wall. When a uterine contraction occurs the obstetrician applies his hand to

[1] Centralblatt für Gynäkol., 1881.

the organ, the palm upon the fundus, the four fingers upon the posterior and the thumb upon the anterior wall, and exerts a moderate pressure, which is soon followed by the expulsion of the placenta—it is thus *expressed*, squeezed out "as the seed from a ripe cherry compressed between the thumb and fingers." It is necessary in some cases to repeat this manipulation once or oftener before successful. Credé's method has not escaped criticism. Riol[1] justly states that if practised with too much rapidity and energy, and immediately after the delivery of the fœtus, it may cause tearing the membranes and retention of fragments. It would be better in physiological cases not to hurry uterine action by friction, but simply to keep the hand applied to the uterus, as first directed, acting in the beginning as a sentinel to warn of danger and advise of condition, and then as an ally of uterine contractions when they normally occur, a reinforcement to uterine power, not usurping its place, but simply assisting it. Delivery of the placenta by expression is certainly preferable to that by traction; it is nature's way to have the deliverance made by a *vis a tergo*, not by a *vis a fronte*, and untimely pulling upon the cord can cause inversion of the uterus, or serious hemorrhage. But granting all this, haste and great force in expression are an evil; Nature should be the guide, give the signal for action, and art be the follower and servant.

Pajot advises, after grasping the cord, at first to exercise a prolonged tension during some minutes, and subsequently moderate tractions in the pelvic axis. Ribemont-Dessaignes[2] claims that this tension is as rational in principle as it is fortunate in results. Pajot's method, instead of trying to increase the size of the uterine orifice, seeks to reduce the volume of the placenta; and this reduction, favored by the special structure of the organ, is easily obtained if the latter is permitted to mould itself little by little to the passage it must traverse—in a word, to accommodate itself.

"No teaching as to the delivery of the placenta can be scientific which does not direct attention to the character of the preceding labor; and as the character of labors varies, so must the management of the third stage. If the pains have been frequent and energetic, and the birth of the child rapid, the placenta may be delivered very soon; if the labor has been tedious and the delivery slow, or if the uterus has been exhausted by long continuous effort, time must be given for the recuperation of its contractile force and nervous energy."[3]

It is generally advised that in removing the placenta from the vagina the former should be rotated so as to twist the membranes into a rope, as it is supposed there is then less danger of their tearing and fragments being left behind. Such an accident is not likely to happen if they have been completely detached from the uterus, and the manœuvre is hardly necessary, simple, gradual withdrawal being sufficient. When removed, the placenta and membranes are put in a vessel brought by the nurse, which should be turned upon its side, and put with its rim as near the vulva as possible, so that they can be slid in rather than lifted, thus avoiding, as far as possible, soiling the clothes or the person of the patient. After this the obstetrician removes clots that may be in the bed, and puts them into the vessel, when it is taken away, but kept

[1] Etude Critique et Clinique de la Déliverance par Expression.
[2] De la Déliverance par Traction et par Expression. Paris, 1883.
[3] Reeve: Transactions of the Ohio State Medical Society, 1884.

unemptied until he has an opportunity to examine the uterine surface of the placenta, and be sure that no fragments have been left in the uterine cavity. Before removing the hand which has been applied to the uterus through the abdominal wall, the size, position, and firmness of the uterine globe should be found to be normal.

Application of the Bandage. After the removal of soiled clothes the abdominal bandage may be applied. The value of this has often been disputed, nevertheless most patients think themselves more comfortable with it, and desire it to be used; indeed, some are not satisfied unless their professional attendant applies it.

Confirmation of the value of the abdominal bandage has recently been given by Prochownick.[1] It should be worn not merely while lying in bed, but for some time after beginning to sit up. Usually a bandage made for the occasion is at hand; but if not, a bolster cover, as suggested by Leishman, or, better than it, a moderately coarse crash towel may be used. The bandage is rolled one-half its length, and the roll carried under the patient's back to the opposite side, when it is unrolled, drawn so as to be smooth, and arranged to extend from the chest somewhat over the hips. It is then pinned as tightly as is comfortable, the pinning being begun, as taught by Warrington,[2] above, though of course this is not very material. To prevent the bandage from slipping a layer of cotton wadding may be placed upon the abdomen, if the weather be not so warm that this addition will cause discomfort. Some place a pad, formed of one or more folded napkins, upon the abdomen before the bandage is fastened, for the purpose of producing compression of the uterus: if small, it does neither good nor harm; but if thick, it may press the uterus out of place. A better plan of securing uterine compression, should this be thought necessary, is the following: Make three firm rolls rather thicker than the wrist, of as many towels; then place one of them transversely just above the uterus, and the other two at its sides, and let the bandage be pinned firmly over them; thus the uterus is as it were included in a box, the lid of the box being the portion of the bandage in front of the abdomen.

A warm vaginal injection of a 3 per cent. solution of carbolic acid, or a $1\frac{1}{2}$ per cent. solution of lysol, or a teaspoonful of creolin to a quart of water, may be used, and with this solution the external sexual organs and adjacent parts are washed.

If there be the slightest suspicion of any injury to vulva or perineum, it is the duty of the obstetrician to make a careful inspection of the parts after the washing. As a rule, should there be any serious tear of the perineum sutures must be at once introduced. Slight tears there or elsewhere may be covered with an antiseptic powder, as of iodoform. Then an antiseptic napkin or pad is applied to the vulva, the chemise and night-dress drawn down, and the patient prepared for that rest which her exhausted state so much needs.

Dr. Fullerton, in her excellent work upon *Obstetrical Nursing*, gives the following description of the antiseptic dressings used in the Woman's Hospital, Phila-

[1] Op. cit. [2] Obstetric Catechism.

delphia: "They consist of a piece of dry patent lint, six by eight inches, which has previously been rendered antiseptic by saturation in a solution of bichloride of mercury 1:1000. This is placed, doubled in its width, so as to make a dressing three by eight inches, directly over the external organs of generation. This lint is covered by a piece of gutta-percha tissue, four by nine inches, which is wet in a 1:4000 solution of bichloride of mercury. These dressings are kept in place by a napkin of sublimated cheese-cloth, eighteen inches square, folded to form a diagonal five inches in width, within whose folds a pad of oakum is enclosed. The napkin is tightly fastened to the abdominal bandage, both anteriorly and posteriorly, by means of safety-pins, and the access of air to the vagina is thus prevented. These dressings are changed at least once in three hours, the dressing removed being at once burned. It is seldom necessary to continue the dressings longer than two weeks."

In my own practice I direct, instead of this "occlusive dressing," simply a pad of absorbent cotton that has been dipped in a 3 per cent. mixture of creolin and water, and dried; this pad will be retained without the napkin if placed between the thighs closely upon the external genitals, or the napkin may enclose it, and be fastened in front and behind to the abdominal bandage. Of course, the pad will be removed as soon as soiled, a fresh one applied, the old one burned. Winckel advises a pad of salicylated cotton, and Auvard says that "it is the best and most simple barrier against the entrance of microbes."

Kältenbach directs the application of sterilized cotton or jute to the genitals.

The practitioner remains with the patient for an hour after the labor has ended, and then, if she be comparatively free from suffering, the uterus well contracted, and the pulse and flow normal, he need not hesitate to leave.

The woman is now, in the strict sense of the term, a *puerpera*, and the puerperal state has succeeded that of labor. The phenomena and management of puerperality will be studied hereafter.

CHAPTER XIII.

THE CONDUCT OF LABOR (CONTINUED)—OCCIPITO-POSTERIOR POSITIONS—FACE, BROW, AND PELVIC PRESENTATIONS—TWINS.

THE MANAGEMENT OF OCCIPITO-POSTERIOR POSITIONS. As has been stated, in almost all cases of right or of left occipito-posterior positions the occiput rotates in front and the head is delivered as in an original occipito-anterior position. The labor is longer and the suffering greater. In exceptional cases, when by perversion of rotation the occiput turns into the sacral cavity, the delivery of the head causes increased danger to the perineum, and the long and difficult labor greatly endangers the life of the child.

The tediousness of anterior and the possibility of posterior rotation have led many obstetricians to urge the importance of manual or even of instrumental means to effect or assist the former.

Smellie was among the first to claim that such rotation could be effected by the hand or by an instrument. He stated, referring to the former means, that "turning the forehead into the hollow of the sacrum might be assisted by introducing some fingers or the whole hand into the vagina during a pain, and moving it to the right position." Portal and Leroux advised pressing with the hand upon the abdominal wall so as to withdraw the face from the anterior pelvic wall. Velpeau taught that when the head had descended into the pelvic cavity, almost immediately after the escape of the waters, two or three fingers should be placed just before the sacrum, in order to push the occiput in front or behind the pubes, upon the side of the forehead, in order to press the latter backward. Meigs, referring to delay in labor from failure of anterior rotation, directed that two fingers should be placed upon the child's head, just behind the ledge formed by one of the parietal bones overriding the occipital, and then drawing the vertex down, thus increasing flexion; he added, "If such gentle measures will not succeed, we have the powerful resource of half the hand, which may be introduced into the vagina, and sometimes within the cervix, and which, taking the head in its palm and fingers, can place the vertex wherever it may be desirable to fix it." Hodge's view was that anterior rotation could generally be caused by pressing on the temple during a "pain" and also in the interval; the pressure should be made upon the left temple in right occipito-posterior, upon the right temple in left occipito-posterior position. Mattei believed that he had often succeeded in effecting anterior rotation of the occiput by acting upon each pole of the fœtal ovoid, the fingers of the right hand being used to draw the occiput in front, while the left hand was applied to the fundus of the uterus to cause a corresponding rotation of the trunk. Tarnier advises this plan: When the os is nearly or quite dilated introduce the index finger—the left one in right occipito-posterior position—and apply it to the cranial surface immediately behind the left ear of the fœtus, thus securing a good purchase; at the beginning of a uterine contraction the finger is pressed firmly, but without violence, at the same time bringing the head toward the pubes, then to the joint, and finally to the opposite side, so that the occiput is directly in front. The first attempt often succeeds, but if, after being repeated two or three times, there is still failure, it is better to desist.

Angus MacDonald[1] held that in all persistent occipito-posterior positions we may safely assume we have some pelvic peculiarity or

[1] Transactions of the Edinburgh Obstetrical Society, vol. iii.

disproportionately large head to deal with, and, as a rule, all attempts at rectification of the position of the head will prove abortive, and are even dangerous if attempted by means of levers, forceps, etc. Not dissimilar was the teaching of Cazeaux; he regarded all manœuvres to effect anterior rotation as quite useless. So, too, Charpentier looks upon manual efforts as in vain, and when they appear to succeed the rotation would occur without them.

The Management of Face Presentations. The older obstetricians advocated in presentation of the face either changing it into that of the vertex or podalic version. Louise Bourgeois, 1710, remarked that when the chin advanced first in the passage delivery was impossible, and the hand must be introduced to push back the chin upon the chest. Baudelocque advised the same method, and if it failed only podalic version or instrumental delivery remained. Smellie said that when the "face presents resting upon part of the pelvis, the head ought to be pushed up to the fundus of the uterus, the child turned and brought by the feet." He admitted, however, that in some instances spontaneous delivery occurred. Paul Portal, 1685, nearly a century before Smellie made the statement I have quoted, was contented with "anointing the woman's parts with butter in order to soften and relax them, thus making the escape of the infant easier:" he stated that the accoucheur should be careful not to produce any irritation with his finger, otherwise he will cause a thousand times more injury to the mother and to the child than the accouchement, which has no more mystery than a natural labor. It was not, however, until Lachapelle asserted that these labors terminated as easily as those with vertex presentation that the profession generally abandoned interference, leaving the delivery to nature. Nevertheless the affirmation of the perfect safety of labor in presentation of the face is somewhat an exaggeration, and the profession is not unanimous in regard to the uselessness of intervening. Hodge held that when the practitioner was called early, and recognized a face presentation, he should, after the os is dilated and before the presenting part has passed this opening, substitute the vertex, for under these circumstances, especially in multiparous women, the operation can be easily and rapidly performed without much suffering to the mother.

Partridge has also advocated this plan of treatment, stating the conditions favorable to it and the method, as follows: "An os nearly or quite dilated; a face not engaged in or at least capable of being lifted from the pelvic brim; an unruptured bag of waters; a capacious vagina. In the majority of labors a stage is reached when these conditions are present. Chloroform to relax the structures of the parturient canal, to quiet the movements of the patient, and to obviate pain caused by the introduction of the hand into the vagina, is of primary importance. The manipulation requires the presence of the fingers only in the uterus, and does not involve any laceration of the cervix. Passing the palms of the fingers over the occipital bone, and pressing them firmly against it, traction downward should be made. In our endeavors flexion of the head almost immediately commenced and quickly became complete. The other hand aided greatly by external manipulation."[1]

Schröder, referring to conversion of a face into a vertex presentation, stated that Thorn succeeded in 9 cases of 24 in accomplishing this change without difficulty; and further, he is correct in asserting that a good result is not to be had

[1] American Journal of Obstetrics, 1884.

by external and internal manipulation of the head alone, still less as Schatz proposes by external manipulation of the head and shoulder, but that the half or the whole of the hand should be used internally to turn the head, while the external hand is employed to press it toward the chest, and finally pushing the breech to the other side so as to change the position of the body.

Penrose's[1] method of treating face presentations is as follows: "The assistance which I advise in all cases of face presentations of mento-anterior positions is, as soon as the mouth of the uterus is dilated and the face has fairly engaged, to apply the hand, the lever, or the blade of the forceps to the posterior cheek, to bring artificially a force of resistance to bear on the face, inasmuch as the face cannot secure this force of resistance from the muscles of the pelvic floor, as the vertex does in vertex presentations, and therefore the chin does not rotate, or does so slowly and uncertainly, to that part of the pelvic cavity where a spontaneous termination of labor is alone possible. If the medical attendant apply this force of resistance at the time and in the manner I have directed, rapid rotation will be secured and the labor will terminate speedily and safely."

In case the chin is posterior and is seen in time—that is, before the face has passed the mouth of the uterus—he urges prompt employment of cephalic or of podalic version.

Pinard, too, advises changing a face into a vertex presentation. His method is acting upon the forehead with two fingers introduced into the vagina, pressing the forehead up, while the other hand is used through the abdominal wall to press the occiput down; the manœuvre is generally successful. Most obstetricians will agree that if the head has not escaped from the os, and if the chin is posterior, that the effort should be made, especially by the method of Pinard, to convert the presentation into that of the vertex. Runge takes the ground that the treatment of this presentation should be expectant.[1]

In conducting the labor, the presentation remaining unchanged, the obstetrician must exercise great care in digital examination lest injury be done, especially to the eyes. It is better frankly to tell the patient that the labor will be protracted, but at the same time she may be assured that it is almost certain to have a fortunate issue both for herself and for her child. Friends who are with her ought to be informed of the probably very great disfigurement of the child's face, the statement being also made that this is sure to disappear in a few days. Great danger comes to the child in the disengagement of the head, for during this the throat is pressed against the pubic arch, and if delay occurs it may be necessary actively to assist the delivery.

Management of Brow Presentations. As extension of the head gives presentation of the face, so partial extension results in presentation of the forehead or brow. Upon digital examination the apex of the forehead is found to be the lowest part of the head, the suture between the two halves of the frontal bone can readily be traced to the anterior fontanelle, and in the opposite direction the different parts of the face are found. Now it is almost certain that the presentation of the forehead will be only temporary; for either flexion occurs, and the vertex presents, or, and this is the more frequent, extension becomes complete, and the final presentation is the face. If the head be small, spontaneous delivery is possible without change of presentation. Kleinwächter takes the ground that when the head is in the pelvic cavity an attempt to substitute the vertex for the face is not to be made, for even if successful the head, which has already been more or less moulded into the form necessary for delivery, must undergo a new configuration

[1] American System of Obstetrics, vol. i. [2] Op. cit.

for delivery with a new presentation, and thus time is lost, to the danger of both mother and child. Hodge taught that a brow presentation should be converted into that of the vertex as soon as the os uteri is sufficiently dilated for the passage of the hand of the practitioner. Even when the head has passed the os he thought this could be done in many cases. Possibly his advocacy of an early active interference arose from the fact that he did not recognize the almost unexceptionally spontaneous change of presentation, for he cautiously observes, "perhaps in the majority of cases" this change occurs. Hildebrandt directs that in persisting brow presentation the woman should be placed upon her side across the bed, and the practitioner then apply two fingers of the right hand, at the beginning of a uterine contraction, upon the forehead and exert a pressure directed toward the occiput if a facial presentation is desired, or toward the face if descent of the occiput is preferred. Long advises the same method, but urges the importance of conversion into a vertex presentation. He adds: "If this is unsuccessful, the whole hand should be introduced into the vagina and the fingers passed up over the occiput, pushing the head up first if necessary, and then drawing downward upon the occiput, and with the thumb pushing up the brow as well as possible, so that the head should be completely flexed. Assistance can sometimes be had by external manipulation with the other hand, and sometimes by having the woman in the knee-chest position. Anæsthesia should always be induced in order to relax the parts and render the manipulation painless."[1] Thorn's method, previously stated, may be employed in this as well as in presentation of the face.

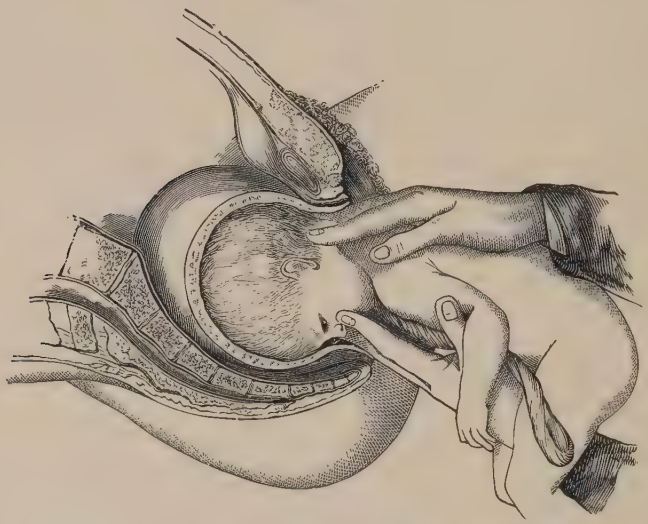
The Management of Pelvic Presentations. The practitioner must guard against an early rupture of the membranes, and even though the first stage of labor is protracted it is well to have the woman lying down most of the time. No effort should be made to hasten delivery during the expulsion of the lower half of the body; no traction upon the trunk is to be exerted, for it may cause not only departure of the chin from the chest, but also of the arms to the sides of the head or even behind it. If the patient be anæsthetized, great care must be taken that the anæsthesia is not to such a degree as to lessen either voluntary or involuntary expulsive power when those forces are essential for the prompt expulsion of the upper part of the trunk and of the head. One hand protects the perineum during the expulsion of the breech, which is received by the other. As soon as so much of the body is born that the umbilical cord comes within reach, a loop must be drawn down to guard against stretching and pressure, and also to know by the pulsation the condition of the child; if the cord be around one of the limbs, it should be removed from this position; next it must be placed in such position that it will be least liable to pressure; that is, where there is the most room for it, and this will generally be upon one or the other side of the sacral promontory. If the arms have departed from the chest, an accident which is not likely to occur unless traction has been made upon the trunk, they are to be brought

[1] American Journal of Obstetrics, 1885.

down, the sacral arm first, by passing two fingers up to the shoulder, and along the inner side of the humerus, if this be possible, to the bend of the elbow, and then by gentle pressure drawing the forearm over the breast, causing the dislocated member to be returned by a movement the reverse of that which displaced it. But if it is impossible to reach the elbow, the finger or fingers must be passed over the acromion and pressure made directly upon the upper part of the humerus, and gradually carried further toward the elbow, until both are drawn down. Rotation of the face into the sacral cavity next occurs, the shoulders now being transverse with reference to the vulval orifice; it may be assisted by making external rotation of the shoulders.

Delivery of the Head in Head-last Labor. Although placing here much which would be properly presented in the chapter upon obstetric operations, it seems to me best now to consider the different manual means used in the delivery of the head when it comes last.

Fig. 138.



Artificial Delivery of the Head in Pelvic Presentation.

1. Continued flexion of the head is sought by assisting uterine contraction with manual abdominal pressure, and by passing two fingers of one hand into the vagina which press upon the superior maxillary, while two fingers of the other hand push the occiput up. This method is illustrated in the subjoined figure.

Smellie[1] employed it, and it will usually be successful.

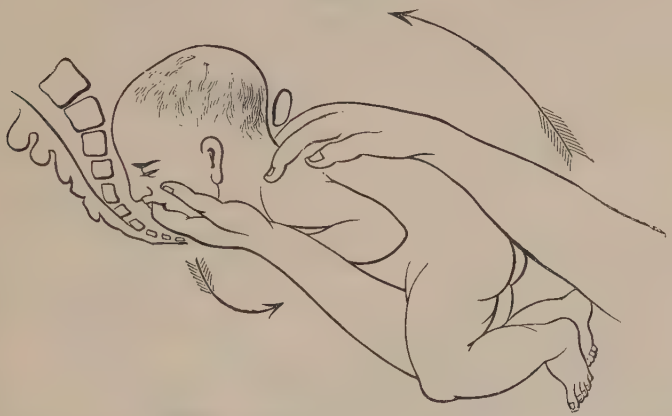
2. That which is called the Prague method, though probably originating with Puzos, is traction upon the child by grasping the ankles with one hand, while the other is placed over the shoulders, three fingers on one side of the neck, the thumb and index finger upon the opposite side; the pull is at first downward and backward until the head has

[1] Smellie performed traction upon the lower jaw in these cases, and it was only when he "was afraid of overstraining it" that he changed the pressure of his fingers to the superior maxillary.

entered the pelvis, then upward and forward, the back of the child coming nearer the mother's abdomen as the head emerges from the vulva.

3. A better method is represented in the annexed illustration. It was employed by Mauriceau, but is commonly known as the Veit-Smellie method. It will be seen in the illustration that two fingers of one

FIG. 139.



MANUAL EXTRACTION OF THE AFTER-COMING HEAD: COMBINED TRACTION UPON MOUTH AND SHOULDERS (VEIT'S METHOD).

hand are passed into the mouth to exert traction upon the lower jaw, while the fingers of the other hand pull upon the shoulders; flexion is secured partly by the direct force exerted upon the inferior maxilla, and partly indirectly by the resistance furnished at the pubic joint to the descent of the occiput.[1] The trunk must be lifted up as the head descends further into the vulvo-vaginal canal.

4. This, known as the Wigand-A. Martin method, is the best[2] of all in a difficult delivery, and when it is important it shall be quickly effected. It is seen that two fingers of one hand are introduced into the child's mouth which pull upon the lower jaw, while the other hand is used to press through the abdominal wall upon the head; traction and expression are thus combined.

While as a rule in head-last labor the face rotates into the sacral cavity, the reverse rotation may occur, and the occiput is found posteriorly, deflection may follow and the chin rest over the pubic joint. It is necessary in such condition that the occipital end of the occipito-

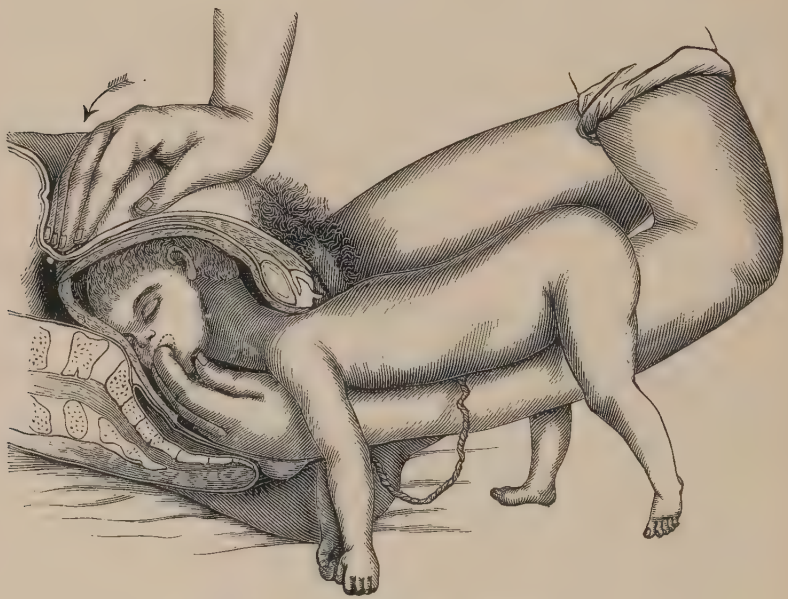
[1] Litzmann, Centralblatt f. Gynäkol., 1887, referring to the method commonly "known as the Veit-Smellie, which ought to be called the Mauriceau-Levret," modifies it according to the suggestion of d'Outrepont thus: The nucha is seized between the index and ring-finger, the medius is placed against the occiput behind the pubic joint, and is used to press it upward; later, when stronger traction upon the shoulders is to be made, the medius is replaced by the ring-finger.

[2] Eisenhart, assistant at the Munich Frauenklinik, has published a paper, Archiv f. Gynäkol., 1889, contrasting this with the Veit-Smellie method, and from comparing the results of the two in a large series of cases arrives at this conclusion: The delivery of living children, and of children that continue living, is at least seven times greater when pressure is made upon the after-coming head by the Wigand-Martin-Winckel method than when the Mauriceau-Lachapelle (Veit-Smellie) method was employed. Herzfeld, Centralblatt f. Gynäkol., 1890, comparing the results from the Mauriceau (Smellie-Veit) method in head-last labor, gives preference to this over the Wigand-Martin, and considers that it may replace the forceps. His statistics show a slight preponderance of the Mauriceau method in favorable results.

mental pole pass out first, and therefore in the delivery of the child the body is carried upward and forward, abdomen of the infant toward the abdomen of the mother.

In any of these methods in which the fingers are introduced into the mouth great care must be taken lest injury is done with a nail to the delicate mucous membrane; I have seen one child bleed to death from injury thus inflicted, and while I know that the obstetrician usually comforts himself with the reflection that the child was "a bleeder," I am not sure that the explanation is always true; the hemorrhage may occur when there is not the slightest proof of any hereditary influence.

FIG. 140.



WIGAND-MARTIN METHOD. (WINCKEL.)

As to the amount of force that may be safely exerted in traction upon the lower jaw, Matthews Duncan from his experiments states[1] that fifty-six pounds may be applied, in some cases, by dragging the lower jaw without producing any easily discovered injury of parts.

A serious source of delay in the delivery of the head arises in some cases from contraction of the os uteri around the neck of the child, causing a dangerous compression of the throat. Depaul, who has described the occurrence of this obstacle, advised the use of the fingers, introduced into the os to dilate it, and, if resistance continues, incisions.

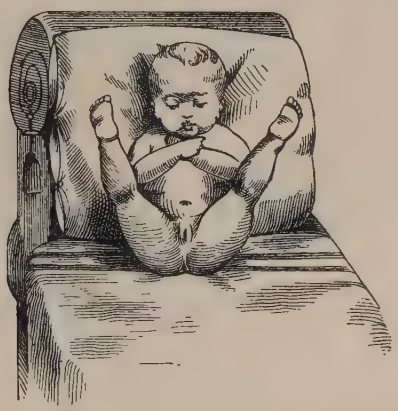
PRESENTATION OF THE HIPS. Delay in the delivery of the pelvis in the usual form of pelvic presentation may require, in the interest of the mother or of the child, manual assistance, and there is usually no difficulty in bringing down one foot, or both feet, so that traction can then be readily exerted. There is, however, an unusual form of pre-

[1] London Obstetrical Society's Transactions, vol. xx.

sentation in which not only are the thighs flexed upon the abdomen, but the legs extended upon the chest; it is described by French obstetricians as *presentation des fesses* or as *presentation du siège décompléte, mode des fesses.* The lower limbs in this position act as a splint to the body, and make it rigid and inflexible. The diagnosis of presentation by abdominal palpation presents a peculiar difficulty from the vicinity of the feet to the head, for, as a rule, when a solid, round body is felt with small mobile parts near it, the conclusion justly drawn is that the body is the hips, so that in a case of this variety of pelvic presentation the error of believing that the head is in the lower part of the uterine ovoid can be very readily committed. It may be, too, that the hips have entered the pelvic cavity before the labor begins, and hence new difficulty and increased liability to error in diagnosis by abdominal palpation. These cases are the most unfavorable variety of pelvic presentation, and, as a rule, assistance is necessary.

Lefour, in an interesting paper,[1] refers to primitive cases of this anomalous position of the lower limbs as distinguished after birth by the fact that though the limbs be drawn down, immediately when they are free from constraint they return to the position they had in the uterus. Fig. 141 shows this peculiarity.

FIG. 141.



POSITION OF LOWER LIMBS IN CHILD BORN WITH PRESENTATION OF THIGHS.

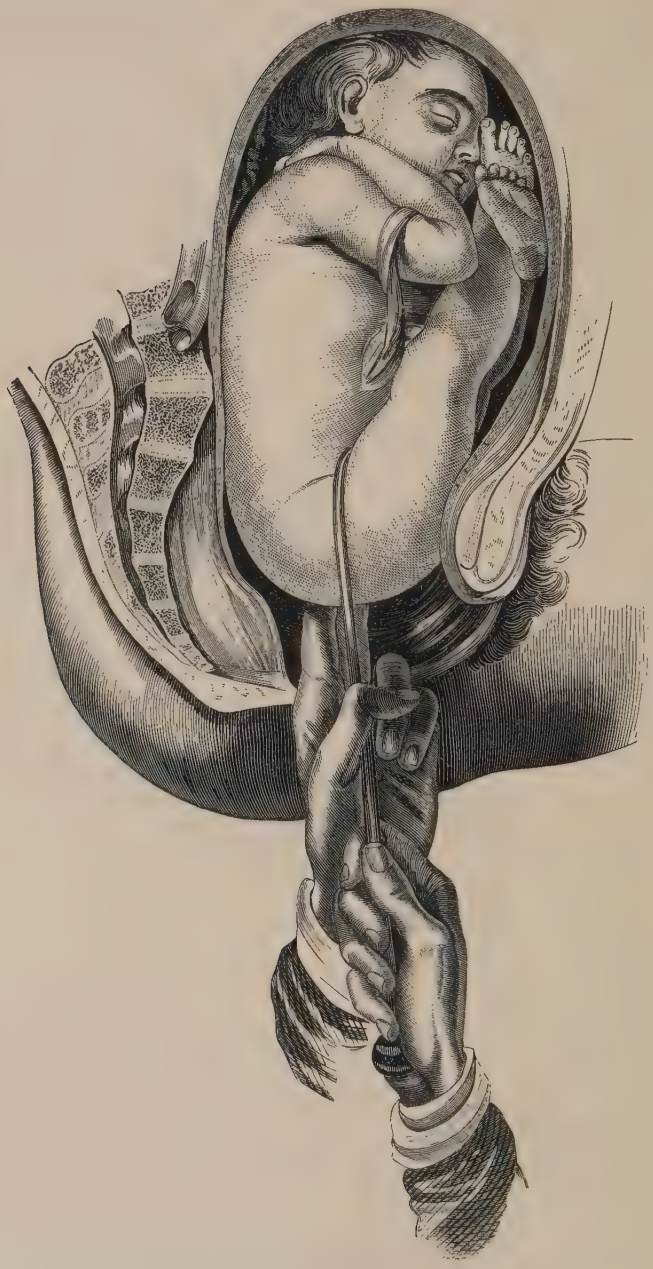
TREATMENT. There will be presented not only the means necessary in this, but in other cases of difficult and delayed pelvic delivery.

The forceps may be rejected as a most uncertain, and possibly unsafe, means if there is really a serious delay in the delivery of the hips. I do not believe this instrument can be safely used to overcome any great resistance under such circumstances.

The blunt hook applied over the anterior thigh is frequently used. Fig. 142. There is danger of fracturing the thigh; Bitot has shown that the femur will be fractured by a force of fourteen to fifteen kilogrammes acting perpendicularly to the axis of the femur. By consulting Fig. 143 it will be seen that any traction upon the anterior hip is

[1] Contribution à l'Etude des Presentations du Siège décompléte, mode des Fesses.

Fig. 142.



Breech Presentation. Application of the Blunt Hook.

not made directly, only indirectly, upon the part which ought to be first advanced, the posterior hip, and therefore there is loss of force.

Nevertheless the blunt hook may prove useful; that of Delore is to be preferred.

The fillet as advised by Galabin may be tried. A soft, oiled handkerchief may be used for the fillet; a knot is tied in it at two opposite corners. By means of the forefinger the corner is to be passed from without inward over the flexure of the groin till the knot can be reached between the thighs and drawn down. In the same way the opposite end of the fillet is to be passed from within outward over the other thigh. The centre of the fillet is then slipped up over the buttocks till it surrounds the sacrum, and traction is made by the ends. In this way the pressure is distributed over both groins and the circumference of the pelvis.

Fig. 143.

Budin and Lefour's Method of Traction.

With such a fillet traction is not only exerted over a great extent of surface, and therefore with less danger of injury, but the pull may be made approximately in the line of resistance. If the fillet be placed over either thigh, the danger of its slipping, and producing fracture of the femur, is not slight. Moreover, the application of the fillet when the hips are firmly pressed in the pelvic canal, possibly considerably swelled, is by no means easy, and may be impossible.

Traction with the finger in the anterior groin may not be difficult, but the force exerted is not great, and, as previously explained, works at a disadvantage; much of it is lost. If the hand is introduced posteriorly to carry a finger over the perineal hip, traction upon which will obviously be much more advantageous, very probably the hips will be pushed up by the entering hand.

Budin and Lefour advise passing one finger in the anus of the patient, and through the anterior wall of the rectum hooking it over the posterior groin, while the index finger of the other hand is passed over the anterior groin, and traction then exerted by the two fingers, as shown in the illustration. This method has succeeded.

Finally, the method advised by Barnes is to be commended, and in general it may be stated that when the obstetrician in a pelvic presentation brings down a foot, he is, as Dr. Goodell happily expressed it, commander of the situation, able if delay occurs efficiently to assist the delivery.

Barnes[1] decomposes the wedge by bringing down a foot, stating that he has on several occasions brought a live child into the world after forceps, hooks, and various other means had been tried in vain for many hours, by passing his hand into the uterus and bringing down a foot. His directions are as follows: "Place the patient on her left side; produce anæsthesia to the surgical degree; support the fundus of the uterus with your right hand on the abdomen; pass your left hand into the uterus, insinuating it gently past the breech at the brim, the palm being directed toward the child's abdomen, until you reach a foot—the anterior foot is the better to take; a finger is then hooked over the instep, and drawn down so as to flex the leg upon the thigh. Maintaining your hold upon the foot, you then draw it down out of the uterus, and thus break up the wedge."

The importance of the proper management of pelvic presentation, more especially of that variety which is being here considered, and which it seems to me deserves a distinct name, and I therefore call it *femoral*, is so great, that I introduce here directions which otherwise would be included in Obstetric Operations: it seems to me that the difficulty and the means of remedying it should be in immediate connection.

When the obstetrician decides in a pelvic presentation to bring down a foot, two questions are to be first answered: Which is the good hand? and, Which is the good foot? The good hand is that which corresponds with the anterior plane of the fœtus. The good foot is that which belongs to the anterior hip of the fœtus. In the subjoined drawing, Fig. 144, the operator instead of seizing the anterior foot has brought down the posterior, and consequently the anterior hip is caught upon the pelvic girdle in front, and delivery becomes impossible, unless the second foot is also brought down.

The next illustration shows that the anterior foot is brought down, and hence no difficulty in the hips entering the pelvis.

But how are we to accomplish what Barnes advises, decompose the wedge, in what the French term *mode des fesses*, or what I have called the femoral variety of pelvic presentation? The hips, let us suppose, are fixed in the pelvic entrance, the amnial liquor discharged, the uterus closely embracing the fœtus, it is impossible, as Farabœuf and Varnier state, to execute the plan of Barnes, carrying the hand along the ventral face of the fœtus, and seize a foot which is at the same level as the head in the fundus of the uterus. But as shown in Fig. 146, the index

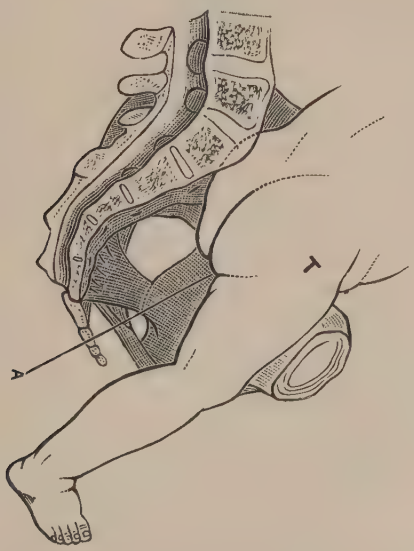
[1] Obstetric Operations.

FIG. 144.

THE WRONG FOOT BROUGHT DOWN. (FARABŒUF and VARNIER.)

and medius can be passed along the surface of the anterior thigh, pressing it outward and backward, making flexion and abduction complete; the inevitable consequence is flexion of the leg, and the foot descends so

FIG. 145.



THE RIGHT FOOT BROUGHT DOWN. (FARABŒUF and VARNIER.)

that it is readily caught between the fingers. This is one of the simplest, most satisfactory, and useful of all obstetric[1] manœuvres.

Fig. 146.

Pinard's Method of bringing down the Foot. (Farabœuf and Varnier.)

It should be remembered, too, that this manœuvre readily secures a foot, and may be successfully employed in those cases in which there has not been complete ascension of the legs, that occurs in the femoral variety, and without violence; the entire hand is not passed into the uterus—only two fingers. If this method were generally adopted, I believe the infant mortality in pelvic presentation would be materially lessened, and there would be fewer instances of fractured femur.

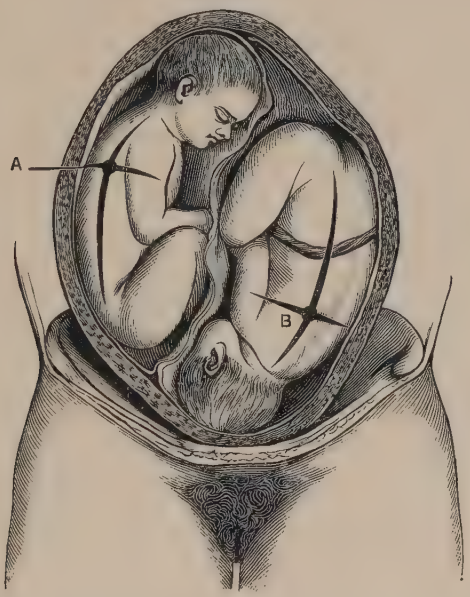
The Management of Labor in Twin Pregnancies. Tarnier's statistics show that in more than two-thirds of pregnancies with twins labor is premature. The reason for this fact is the very great distention of the uterus. The labor is usually longer in both the first and in the second stage. The causes are: the changes in the cervix, belonging to the last period of pregnancy, have not occurred in the majority of cases, and hence increased resistance is to be overcome, the great distention of the uterus lessens its contractile power, and the force distributed over so large a surface is less efficient.

The statistics of Depaul and Tarnier, embracing 316 twin labors, show that in 131 cases each fœtus presented by the vertex; 81 times the vertex of one fœtus and the pelvis of the other presented, and 47 times

[1] Pinard's method is simply a development of that of Madame Lachapelle. Those who will consult the second volume of her "Pratique des Accouchmens," 1825, pp. 88, 89, will find that her practice suggested the method of Pinard.

the pelvis, and then the vertex, while the remaining presentations were of the vertex and of the shoulder, of the pelvis and of the shoulder, vertex and face, face and vertex, etc. Kleinwächter makes vertex presentations 69.58 per cent., pelvic presentations 25.25 per cent., and transverse 5.17 per cent. Most frequently both fœtuses are born with vertex presentation, 49.29 per cent., more seldom one vertex, the other pelvic, 34.49 per cent. Still more seldom does the birth of both occur with pelvic presentation, or of the first with pelvic and the second with shoulder presentation, or both with the latter, 6.23, 6.11, 3.55, 0.33.

FIG. 147.



FIRST CHILD PRESENTING BY THE VERTEX; SECOND BY THE PELVIS.
B and A, points of maxima of intensity of sounds of the fœtal heart.

While usually the twins lie longitudinally in the uterus, placed beside each other, as represented in the illustration, in some cases they may be either one above, or one in front of the other. A full description of the last two anomalous positions of twins has been given by Budin.[1]

In more than one-half the cases the second child is born within twenty minutes after the first. In one of 212 cases given by Collins the interval was twenty hours; twelve hours and forty minutes in 1 out of 188 cases observed in the Paris Maternity; Reuss gives an instance in which the interval was twenty-six hours. When the presentation of the first child is favorable, the rule is no interference is advisable in the first stage of labor; after the os is dilated the membranes may be ruptured and the labor conducted as usual. After the child is born the practitioner, in most cases, knows for the first time that the pregnancy has

[1] Op. cit.

been plural; he finds the uterus firm, nearly as large as it was before the birth of the child, and upon digital examination ascertains that there is a second one within the womb. In all cases a second ligature of the umbilical cord is imperative, for while there probably is no vascular connection between the placentæ, the possibility of its existence requires guarding against destroying the life of the second child by hemorrhage. All traction upon the cord to remove the placenta from the uterus is especially forbidden. If the mother desires to know if she is to have another child, a knowledge which in many cases is by no means pleasant, let the truth be frankly told; she may at the same time be assured that the labor will almost certainly be easy and brief, for not only has the birth-passage been fully dilated, but the second child is generally smaller than the first. If the presentation is normal, the sounds of the fœtal heart distinct, and the mother's condition favorable—none of the grave accidents of labor, such as eclampsia or hemorrhage, present—it is better to wait untill expulsive pains return, and not cause immediate delivery. Supposing that the labor is premature, the child expelled feeble or dead, and the placenta discharged, it is possible, as suggested by Depaul, that the second child may be carried to the full period of gestation, and therefore interference would be forbidden. But when the placenta remains in the uterus there is no ground for this hope, and the practitioner should not leave the patient until she is delivered. As soon as decided pains occur the membranes are to be ruptured, and contraction of the uterus secured by manual abdominal pressure during and for a time after the expulsion of the child; ergot may be given immediately after the delivery of the placenta.

SECTION III.

PHYSIOLOGY OF THE PUERPERAL CONDITION.

CHAPTER XIV.

THE PHYSIOLOGY AND THE MANAGEMENT OF THE PUERPERAL STATE.

PUERPERALITY, or the puerperal state, follows labor, and continues until the genital organs return to their condition prior to pregnancy, and is generally regarded as including a period of about six weeks. But here a qualification of fact and one of time should be stated. There is never an entire restoration of the genital organs, especially in the primipara, to their ante-pregnant condition, the changes caused by gestation and labor are not completely effaced; and, as will be seen in the study of uterine involution, some of the phenomena in this process last much longer than the period mentioned.

While pregnancy was marked by extraordinary hypertrophy, a reverse process especially characterizes puerperality; construction distinguishes one, demolition the other. There was a building up, and now there is a tearing down and removal of structure no longer needed. Moreover, in the early part of the puerperal state a new function is called in exercise, that of the mammary glands; these organs, designed to supply nourishment for the infant during the first eight or ten months of extra-uterine life, enter into action while the ovaries and the uterus rest; ovulation, gestation, and lactation are the three characteristic functions of the female organism, and they are exercised in succession.

It is important to know the physiological phenomena of childbed, so that deviations from them may be at once recognized, and, if possible, promptly arrested. The condition of a woman after delivery has been compared to that of a person who has undergone a grave surgical operation; neither is laboring under disease, but each is more or less exhausted, and each has undergone a traumatism which opens the doors for the entrance of disease-germs, and both need intelligent and constant care to guard against danger and to guide to perfect recovery.

The woman who has just passed through childbirth usually enters into a period of calm rest. The stormy struggle, the severe physical suffering, and the anxiety are happily ended for most in quiet and peaceful joy. Generally the puerpera is disturbed by conversation, or by movement of her body; her replies to questions are usually in a low tone of voice and brief, and she desires above all things mental and

physical rest. In some cases there is very great nervous prostration, presenting, as far as frequency of pulse and somewhat difficult respiration are concerned, the characteristics of post-partum hemorrhage, and the heart's action is very feeble, but an error of diagnosis is easily avoided by finding the uterus well contracted and the flow quite normal. Perfect rest, the administration of a stimulant, or a hypodermatic of sulphuric ether with digitalis may be required. But these are quite exceptional cases, and much more frequently a chill occurs. In about one-third of parturients there is a chill during labor, or soon after; the latter is the more frequent. This chill, which is oftener observed after a rapid labor, lasts from a few minutes to a quarter of an hour; it is not attended with any change in the pulse or in the temperature. The most probable explanation of this phenomenon is that the organism suddenly loses a mass to which it had been progressively accustomed, and this rapid depletion of the abdomen causes immediate cessation of compression of the viscera, the blood leaves the exterior to fill the space left in these organs. But, whatever the explanation, the chill is physiological, and portends no danger.

After-pains. A still more frequent cause disturbing the rest of the newly delivered woman, if she be a multipara, is the occurrence of painful contractions of the uterus. These are more severe after a rapid labor; indeed they may be absent if it has been slow, they only exceptionally occur in primiparæ, and they are more frequent, too, if the uterus has been greatly distended. They generally begin a short time after the expulsion of the placenta, recur at intervals of five, ten, fifteen, or twenty minutes, and disappear after twenty-four hours; they are excited or increased by the application of the child to the breast; exceptionally they continue for two days, or even somewhat longer. When after-pains are very close together, and continue thus for some hours, the fact is cause for anxiety, as they may indicate the beginning of a metro-peritonitis, and the temperature of the patient should be carefully watched.

Expulsion of clots is usually caused by these painful contractions of the uterus, and when they are moderate in severity their occurrence is favorable, for they show a uterine activity which is a safeguard against hemorrhage. The diagnosis ought not to present any difficulty, for the hand placed upon the abdomen recognizes the contraction of the uterus.

But there may be very severe attacks of "uterine colic" occurring within a few days after birth, in some cases even causing marked temporary elevation of temperature, which are purely nervous; just as there may be vesical or rectal tenesmus, so there may be a similar disorder of the uterus, and in each case the organ affected be quite empty.

Prochownick has shown[1] that in some cases of diastasis of the abdominal muscles the intestine may protrude through the opening, and pain result, which may be mistaken for after-pains, and probably is thus mistaken in many cases. A careful examination will recognize the cause of suffering.

The Pulse. During labor the pulse usually increases from 70 or 75 to 90 or 100; but a short time after delivery its frequency lessens, sinking below the normal in from eight to forty-eight hours; usually

[1] Op. cit.

the pulse oscillates between 50 and 60, but, according to Blot, between 44 and 56; Olshausen makes it between 40 and 50, and in rare cases says it falls below 40; the lowest that I have observed was 46.

The lessened frequency of the pulse was attributed by Marey to increased blood-pressure, but others assert that this is diminished; by Olshausen to absorption of fat from the uterus, but, as will be presently shown, fatty degeneration of the uterine muscular tissue does not occur; to the position of the woman, and to complete mental and bodily rest. Winckel states that the experiments of G. V. Liebig make it very probable that there is a causal connection between the slowing of the pulse and the increase of the vital capacity of puerperal women.

The slowing of the pulse is justly regarded as a favorable indication, and the slower the more favorable. The duration of this condition is usually several days, and the period when it is greatest is from the fifth to the seventh day (Olshausen); Louage[1] states it is the morning of the seventh day. Buffet says the slow pulse lasts in multiparæ from five to seven days, but in primiparæ only from three to four.

THE TEMPERATURE. During labor there is generally some increase in the temperature, and this increase may continue for twelve hours or more after; it is a little greater in primiparæ, and may amount to two or three degrees F. But within twenty-four hours the temperature declines and remains stationary during seven or eight days, there being only the usual morning and evening variations. The following table gives the result of the average temperatures of twelve patients in whom puerperal convalescence occurred without disturbance; the first temperature was taken twenty-four hours after delivery.[2]

	Morning.	Evening.
First day	98.4°	98.8°
Second day	98.4	98.8
Third day	98.2	98.8
Fourth day	98.2	98.4
Fifth day	98.2	98.9
Sixth day	98.4	98.8
Seventh day	98.	98.4
Eighth day	98.2	98.4

The highest temperature observed in any one of these twelve women was $98\frac{4}{5}°$, and this occurred on the fifth day. Transient elevation of temperature may arise from mental causes, from disorders of the digestion, or from getting up too soon. But, as Tarnier remarks, these momentary elevations do not generally involve an unfavorable prognosis; it is not the same with those that are progressive and continued; especially when the thermometer placed in the axilla ascends above 100.4°, some complication ought to be feared.

RESPIRATION. The pulmonary capacity, according to Dohrn's investigation, increases in the majority of cases; the respirations are from 14 to 18 per minute.

PERSPIRATION. Increased action of the sudoriparous glands occurs in the first week of the lying-in; the perspiration is especially abundant during sleep. It has been asserted that if the patient have good

[1] Le Pouls Puerpérale Physiologique, par Pierre Louage. Paris, 1886.

[2] I am indebted to Drs. Phillips and Randall, resident physicians in the Obstetric Department of the Philadelphia Hospital during one of my terms of service, for the preparation of this table.

nourishment, if she be lightly covered, and if the room be well ventilated this increase of secretion may not occur.

The congestion of the skin of the scalp, according to Naegele, causes exudation in the hair-follicles, and hence falling out of some of the hair is not uncommon.

Renal Secretion. The quantity of urine in the first eight days, Kehrer states, is increased in comparison with that of the non-pregnant, but lessened in comparison with that of the pregnant woman. Milk-sugar is found in the urine from the third day, especially if there be an abundant secretion of milk. This is known as a resorption glycosuria —the sugar being received into the blood from the milk glands and eliminated by the kidneys; it would be more appropriately called lactosuria.

Peptone, according to Fischel, is found almost without exception in the urine from the second to the tenth day; it is derived from metabolism of albuminous elements of the uterine muscle. The urine in a limited number of cases contains albumin; this albuminuria may be simply that of pregnancy, or that originating in labor, continued, or may now first appear. The urine also contains small quantities of acetone. (Winckel.)

Retention of Urine. Inability to evacuate the bladder is not uncommon, especially in primiparæ, if the labor has been protracted. The causes of the urinary retention are the ample space given the bladder to resume its spherical form, while during the latter part of pregnancy it was flattened, the swelling of the urethra and the neck of the bladder from severe compression in labor, the loss of abdominal pressure, and the unaccustomed position the patient occupies while attempting to urinate, that is, horizontal. If the bladder be distended with urine, the uterus is carried higher up in the abdominal cavity; such distention, too, may cause secondary hemorrhage.

Condition of the Digestive Organs. The desire for food is less in the first two or three days, but in consequence of the activity of various secretions, especially of the kidneys and the sudoriparous glands, the thirst is great. Evacuation from the bowels is delayed, partly because of their having been so thoroughly emptied in labor, and partly because of the character of the food usually taken, and because of the woman being in entire rest.

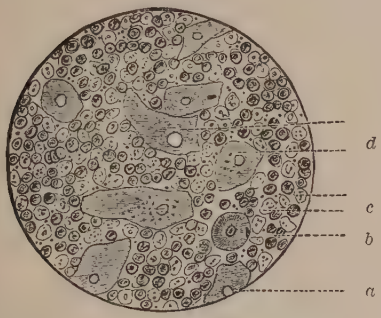
Psychical Condition. The newly delivered woman is peculiarly nervous and sensitive, and disturbed by causes to which she would be ordinarily indifferent.

Lochia.[1] This name is given to the flow from the genital organs in childbed. The discharge comes chiefly from the placental site, and there are mixed with it fragments of the uterine decidua; in normal cases it is free from germs. Passing through the cervix glandular secretion of the latter is added, and in its further progress the secretions of the vagina and of the vulva. The uterine lochia are free from germs

[1] Λοχία, or Λοχεία was one of the names given to Artemis or Diana, from her helping presence at childbirth. From the adjective λοχεῖος, *belonging to childbirth*, we have the words used by Hippocrates, τα λόχια and ἡ λόχια, the discharge after delivery. It would seem, therefore, that lochia may be used in the singular or in the plural.

in a normal puerperium ; injected beneath the skin no abscess or fever results in human beings or in animals; the flow is alkaline. For the first four days the lochial secretion is composed largely of blood, and receives the name of *lochia cruenta.* (Fig. 148, from Winckel.) It then becomes lighter in color and thinner, and is called *lochia serosa.* (Fig. 149, Winckel.)

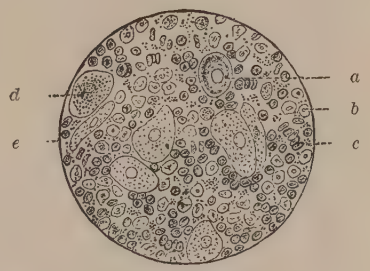
FIG. 148.



LOCHIAL DISCHARGE ON THE SECOND DAY. A FEW ISOLATED COCCI AND STREPTOCOCCI. LOCHIA CRUENTA.

a. Decidua cells. *b.* Red blood-corpuscles. *c.* White blood-corpuscles. *d.* Epithelia.

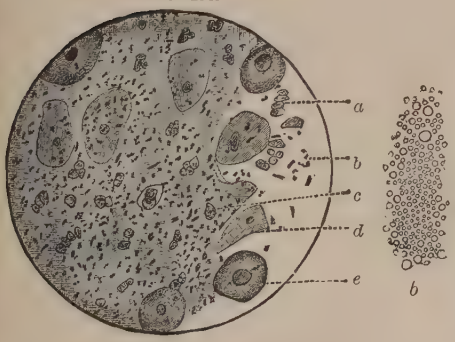
FIG. 149.



LOCHIAL DISCHARGE ON THE FOURTH DAY.

a. Cells of the decidua. *b.* White blood-corpuscles. *c.* A few red blood-corpuscles. *d.* Epithelial cells without nuclei from the vernix caseosa, with nuclei from the parturient canal ; numerous clusters of cocci, partly in cells without nuclei, which are stained blue by Gram's method. × 330.

FIG. 150.



LOCHIA, SEVENTH DAY. NO ELEVATION OF TEMPERATURE.

a Blood-corpuscles. *b.* Diplo- and Monococci. *c.* White blood-corpuscles. *d.* Epithelial cells. *e.* Decidual cells.

FIG. 151.

MAMMA IN LACTATION. × 330.

a. Colostrum. *b.* Milk.

The eighth day it becomes yellowish and creamlike ; it is known as *lochia alba.* The above illustration from Winckel shows the microscopic appearance of the lochia on the seventh day (Fig. 150).

The chemical character of the fluid, according to Döderlein, in the vagina favors the development of saprophytes, streptococci, and staphylococci ; inoculation causes fever and abscess. (Scherer, Rokitansky, Kehrer, Karewski.)

The discharge is greater and lasts[1] longer in women who do not nurse. In normal cases the quantity is, in the fourth week, very small, and then usually ceases, presenting before its cessation somewhat the appearance of uncoagulated albumin. The amount in all is about three pounds and a quarter, the flow of the first three days being about two-thirds of this weight.

During the establishment of the milk secretion the lochia temporarily lessen as a rule, and, on the other hand, increase from great exertion too early after labor, or getting up too soon.

The odor is not offensive, and should it become so the obstetrician is watchful lest puerperal infection occur.

Artemieff[2] states that the lochia of healthy women consist of blood-corpuscles, pavement-epithelium, mucous corpuscles, fatty degenerated cells, and cells which he designates locheiocytes. In the first few days after labor red blood-corpuscles predominate, which gradually diminish, while the locheiocytes become more numerous. With a mixture of pavement-epithelia, mucous corpuscles, and fatty degenerated cells, the locheiocytes constitute the lochia alba. Locheiocytes are larger than pus-cells in the proportion of one to two-thirds.

De la Motte, in his *Traité des Accouchemens*, 1726, gives two cases in which the lochial flow entirely ceased the fifth day, no injurious consequences being observed. But my friend, Dr. Darrach, of Germantown, Philadelphia, has told me of a more extraordinary case, the lochia not appearing at all. Dr. Darrach's patient was a primipara, twenty-seven years old. After some discharge with the delivery of the placenta no flow occurred; she had a normal temperature throughout complete puerperal convalescence.

CHANGES IN THE GENITAL ORGANS. INVOLUTION OF THE UTERUS. A woman immediately after labor has more or less soreness of the external organs of generation. They are tender, and there is the feeling of their having been bruised; if a primipara, there is more or less tearing of the vulval orifice, such injury affecting the fourchette, sometimes the nymphæ, less frequently the labia majora, and in some cases the anterior margin of the vulva. These various parts may become œdematous, but this condition usually disappears in two or three days, and they gradually approximate their condition before pregnancy. The vagina becomes shorter and narrower, but its columns and rugæ never are so distinct as before labor; its muscular tissue is atrophied, while the superficial epithelium of its mucous covering is exfoliated; during the continuance of the lochial discharge there is a catarrhal vaginitis. The layers of the broad ligaments, separated by the growing uterus, re-unite, and the ovaries and oviducts take their usual position in the true pelvis.

But the most remarkable change occurs in the uterus. This organ, which weighs soon after delivery 2.2 pounds, two days later only weighs $26\frac{1}{2}$ ounces. At the end of a week it weighs about one pound, and at the end of two weeks its weight is about $12\frac{1}{4}$ ounces (Spiegelberg). In six or eight weeks it has returned to nearly its size before pregnancy.

[1] According to the law of the ancient Hebrews, Leviticus XII., a woman was unclean for thirty-three days after giving birth to a male child, but for sixty-six days if the child was female. Kehrer, referring to this, makes it equivalent to the statement that the lochia continued these respective periods. (See Müller's Handbuch der Geburtshülfe, vol i.)

Hippocrates taught that the flow lasted twenty to thirty days after the birth of a boy, and after the birth of a girl twenty-five to forty-two days.

[2] Zeitschrift f. Geburt. und Gynäkol.

The process by which this change is effected is called involution. The uterus was progressively evolved in the course of pregnancy to meet the requirements of the new being, and now that gestation has ended, there being no further use for such size and capacity, the organ is involved.[1]

As Kleinwächter remarks, uterine involution begins with the first labor-pains. He further states that the contraction of so large a muscle must go hand-in-hand with a change of matter, increasing to a high degree, and although the production of heat is by the consumption of non-nitrogenous substances, yet long-continued and increased action leads to the destruction of the functionally active contents of muscle-cells. Besides, the formation of new protoplasm is interfered with by the compression of bloodvessels during uterine contractions, and the involution of the muscle is thus in part affected.

In regard to the degree and the character of the changes that occur in the ultimate muscular tissue authorities are not agreed. According to Spiegelberg, the uterine muscular substance, pale at delivery, becomes yellowish from the sixth day, the color being due to a granulo-fatty degeneration of its fibres. But Robin has stated that the presence of minute drops of fat can be seen from the third month of pregnancy; he adds that the diminution of volume of the muscle-fibres is made solely by atrophy which occurs after labor, and he insists that the fatty infiltration lessens as the muscular fibres atrophy. Heschl's view, adopted by most obstetric authorities, attributes very great importance in uterine involution to fatty degeneration. This degeneration begins about the fourth or sixth day in the form of minute fat-drops, which by degrees extend so as to fill the fibre-cells, and soon effect their destruction. From the fourth week a new formation is evident in the external muscular layers, appearing first as nucleated cells which soon become fibre-cells; destruction and regeneration march side by side, and toward the eighth week, the latter is complete. Mayor's[2] investigations led him to conclude that fatty degeneration of the muscular fibres was more marked than Robin thought, but still had not the importance attributed to it by Heschl. From the fact that it was at its maximum at the points where these elements most rapidly resume their primitive volume, he regarded the degeneration as only a momentary transformation of the protoplasm of the cells designed to favor absorption, and the disappearance of the materials which constitute the gravidic hypertrophy.

The doctrine that there is a complete regeneration of the uterus certainly seems improbable. Admitting the truth of Aristotle's statement, that nature does nothing in vain, it seems utterly unnecessary to destroy the whole, in order to remove a part. Moreover, it is somewhat remarkable, that if there is such entire regeneration, a new uterus in fact created, the organ in another pregnancy, and after another labor, behaves so differently from the primitive one; the new uterus is more readily distended, and preserves its typical form less completely; after labor it fails to contract perfectly, and thus permits the accumulation of blood-clots, and consequent after-pains. Nature may go on constructing a new uterus a dozen times even, and the oftener she tries, the more the product of her work deviates from the original pattern.

Sänger,[3] from his studies of the regressive metamorphosis of the muscular tissue of the uterus, arrives at a result directly contrary to the statements of Heschl and of Kölliker, the former asserting entire, and the latter partial, destruction of the muscular tissue. He has found that the muscular fibres during uterine involution lessen in length and thickness until restored to their primitive form and size. The fatty degeneration of the muscular parenchyma has simply the signifi-

[1] Numerous experiments have been tried using ergot daily during the puerperal period, and the conclusion of most observers, not of all, is that involution of the uterus is thus hastened, but some have found that the secretion of milk was lessened. Involution is a physiological process, and ergot is a medicine—its administration presupposes a pathological condition; the healthy puerpera does not need ergot.

[2] Siredey, Les Maladies Puerpérales.

[3] Centralblatt f. Gynäkol., 1888.

cation of nutritive phenomena. There is never found external to the muscular fibrillæ fatty detritus; the combustion of fat-molecules takes place in the interior of the cell, so that the lipæmia to which Olshausen attributed the slowing of the pulse of the puerpera does not exist. Dittrich, from a study of the involution of the uterus in pathological states of puerperal women, embracing 92 cases,[1] has confirmed the view of Sänger.

The restoration of the mucous membrane proceeds at the same time as the involution of the uterus. Normally, the superficial layer of the mucous membrane, the *decidua vera* of Hunter, is detached and expelled with the placenta and membranes; but no small part of it may be retained, passing off by fatty degeneration with the lochia. The uterine glands retain their lining; these are brought closer together by the retraction of the uterus, from the glandular cul-de-sacs epithelium is formed, which extends toward the uterine cavity—these proliferations about the end of the third week, according to Leopold, reaching the surface, and at the end of the fifth week this investment is complete; that is to say, a new mucous membrane, formed from that lining the glands, covers the uterine wall. Very important changes occur at the site of the placenta. In the eighth month some of the venous sinuses are closed by thrombi, and after the expulsion of the placenta the remaining ones are closed in the same way; the thrombi degenerate and are gradually absorbed, but the process is not completed until four or five months after labor.

Changes in the Bloodvessels. It is generally thought that many of these vessels are so firmly compressed by the contraction of the uterus as to undergo fatty degeneration and absorption. The larger arteries are partially obliterated by proliferation of the connective tissue of the *intima;* the *media* is destroyed by fatty degeneration; new muscular elements take the place of the degenerated ones where the vessels are to remain; other vessels are simply narrowed, and continue. According to Balin, the regressive metamorphosis begins later and lasts longer than the same process in the muscular structure of the uterus, occupying several months.

Position and Form of the Uterus. Immediately after delivery the uterus is a round, hard body reaching a little more than four inches, eleven centimetres, above the pubic symphysis, and very nearly the same distance from side to side. A few hours later, either from relaxation or from the bladder being filled, it reaches somewhat higher; subsequently a more or less continuous diminution goes on, so that by the tenth day the fundus is at the superior margin of the pubic joint; the daily decrease in the height of the fundus above the pubic symphysis being from two-fifths to four-fifths of an inch, or from one to two centimetres. During this time its position varies with the position of the patient, but it inclines toward one or the other side, and does not occupy the median line. The puerperal uterus is often anteflexed, and in some cases this anteflexion is so great that an obstruction to the passage of the lochia is caused, and the condition known as lochiometra results.

Depaul gave the following as the approximate relative positions of the fundus of the uterus in the first days of the puerperal state. The first day it is a finger's

[1] Centralblatt f. Gynäkol., 1889.

breadth above the umbilicus; the second day at the level of the umbilicus; the third day a little below; the fourth day but little variation from the preceding; the fifth and the sixth days two fingers' breadth below; the seventh, eighth, and ninth days three or four fingers' breadth above the pubic joint; the tenth, eleventh, and twelfth days at the level of or a little below the pubis.

FIG. 152.

PUERPERAL UTERUS THE FIRST DAYS OF THE LYING-IN. (After a frozen section by WYDER.)

The following is a table given by Ahlfeld as to the position of the uterus above the symphysis, and its width in the first ten days:

	Height above Symphysis.	Greatest Breadth.
After the discharge of the placenta	11 cm.	10 cm.
End of the first day	10.8 "	10 "
End of second day	10 "	9.6 "
End of third day	9 "	8.9 "
End of fourth day	8.4 "	8.6 "
End of fifth day	7.7 "	8 "
End of sixth day	7 "	7.4 "
End of seventh day	6.6 "	7.4 "
End of eighth day	6.2 "	6.6 "
End of ninth day	5.8 "	6.6 "
End of tenth day	5.5 "	

CHANGES IN THE NECK OF THE UTERUS. Directly after birth the neck of the womb is relaxed and soft, and has been compared by Kleinwächter to the vulva; the canal admits three or four fingers readily, but slight resistance is offered by the internal os; the length of the cervix is about 2.7 inches, or 7 centimetres. At the tenth day the canal no longer admits even one finger, and by the twelfth the neck is only 3 centimetres, or a little more than an inch long, according to Lott.

Loss of Weight in Labor and during Lying-in. Gassner states that the body increases during the last three months of pregnancy about one-thirteenth of the entire weight; this increase is proportionally less in primiparæ than in multiparæ; during labor a woman loses one-ninth of that she had at the end of pregnancy, the loss being chiefly due to the expulsion of the fœtus and its appendages and the amnial liquor, but also to the blood lost in the discharge of the placenta, to fecal matter expelled, and to pulmonary and cutaneous excretions. During the first eight days of lying-in the woman loses[1] one-eleventh, the loss resulting from the lochial discharge, the increased action of the kidneys and the skin, and the mammary secretion. This loss, however, is not so great if a good diet be given, as the statements in foot-note show. Further, Baumm, in Winckel's clinic at Munich, has proved that with generous food the loss of weight is about one-fourth less than that observed by Gassner. The total weight lost in labor and in the puerperal state amounts to about one-fifth that of the body. At the end of three or four weeks after labor the loss has ceased, and generally a gain begins.

The Secretion of Milk.[2] During the latter part of pregnancy and immediately after labor a fluid called colostrum is found in the breasts, and often spontaneously exudes or can be pressed from the nipple; to this fluid, as found in the cow immediately after calving, the name of *biestings* is given. An abundant secretion of colostrum in pregnancy indicates a large supply of milk. Colostrum differs in color, specific gravity, and composition, and morphologically from milk. It is yellowish-white, is richer in fat and sugar than milk, and contains albumin instead of casein; it has a larger supply of salts than milk, and hence, according to most authorities, proves a laxative to the new-born child, assisting in carrying off meconium; but this excess in salts is not great, and it is more rational to attribute the laxative property of the fluid, as De Sinéty does, to its richness in glandular elements, which produce indigestion. The following is Marchand's statement as to the composition of the two fluids:

In 100 parts of each—

	Colostrum.	Milk.
Proteine elements	17.20	1.90
Lactine	6 30	5.30
Butter	4.50	4.50
Salts	0.25	0.18
Water	71.63	81.12

The liquid portion of milk is simply a transudation from the blood, while the morphological constituents proceed from the gland cells. Colostrum corpuscles are remarkable for their size, contain fat granulations, and are probably detached glandular elements; either the cell-wall is broken down, and the contents set free, or, as De Sinéty holds, the cells have contractile movements, and by these the fatty particles are expelled. These minute fat granules unite together to form larger masses and of different sizes; their mixture with the transudation from

[1] "Kleinwächter, however, by means of better nourishment, arrived at a different result: he noted only about half the loss of weight reported by Gassner, and Klemmer, in my Dresden clinic, by means of meat diet, succeeded in obtaining not only less falling-off in weight, but in some cases the patient gained up to the tenth day." (Winckel.)

[2] See Fig. 151.

the blood makes a fine emulsion, and this is milk. The casein of milk is probably formed from the albumin of the blood, and the sugar of milk from the glucose.

PHENOMENA ASSOCIATED WITH THE ESTABLISHMENT OF THE SECRETION OF MILK. The current of blood which has been flowing to the uterus for nine months now turns to the mammary glands, and on the second, or oftener on the third day, these organs enlarge and their sensibility increases; the skin covering them is smooth and tense, the nipples are less prominent, and very frequently some pain is felt in the axillary glands; in consequence of the swollen condition of the breasts the arms cannot be brought close to the sides of the chest. The general phenomena attending upon the beginning of the milk flow are restlessness, thirst, headache, occasional neuralgic pains, loss of appetite, and possibly slight increase in temperature and in the frequency of the pulse. But that which the old authors called milk fever is not now admitted; in very rare exceptions decided fever, even preceded by a chill and lasting twenty-four hours, has been observed in cases in which no complication was present, but the almost universal rule is that there is no milk fever; as Lorain remarked, it is a vague tradition which does not rest upon classic observation. Siredey, collecting in one year 360 observations as to changes in temperature, states he can assert that in every case in which the temperature in the axilla exceeded 100.4°, he found the explanation of the febrile movement independent of the lacteal secretion.

Chantreuil's investigation led him to conclude that the morbid entity called milk fever very rarely occurred; that in entirely normal cases the pulse did not rise above 76, and consequently there could be no question about fever, and that the temperature followed the variations of the pulse. In normal cases the temperature did not rise during the secretion of milk above 100.4° or 100.2°, figures which have been adopted as expressing the mean temperature by all authors who have been occupied with the study of thermometry.

The secretion of milk continues from 8 to 12 months. The quantity increases until 6 or 7 months, and decreases from the 8th month. The casein increases until the 2d month, and decreases from that to the 9th, and so also the butter; the sugar lessens the first month, then increases; the salts increase the first five months, and then diminish.[1] If the woman does not nurse, the milk disappears in about a week. Menstruation is, as a rule, absent during lactation, but ovulation may occur, and it is not uncommon for women to conceive while nursing; should conception occur, the supply of milk lessens and finally ceases.

THE MANAGEMENT OF CHILDBED. There will be considered under this head not merely the care of the mother, but also that of the child.

ATTENTIONS TO THE MOTHER.[2] After the thorough cleansing of

[1] Zuelzer, quoted by Kleinwächter.

[2] In some parts of the world it appears that attentions to the father are of great importance, thus—

Peschel, *The Races of Men*, pp. 24-25, refers to paternal lying-in as having been observed by inhabitants of the four quarters of the globe—in Borneo, for example, the father of the newborn child is for eight days allowed to eat nothing but rice, must take care not to expose himself to the sun, and must give up bathing during four days; and states such coincidence of error can be explained in one or the other of only two ways—either all the varieties of our race once dwelt together in a narrow home when the error originated, or the mental faculties of all these families even in their strongest aberrations are the same.

The significance of couvade, or male childbed, is thus given by Dr. Foy, of Dublin, in the British Medical Journal, September 26, 1891: The writer states that "there are good grounds for

the external sexual organs by a warm antiseptic solution and a similar injection in the vagina, the necessary care of injuries,[1] if any have occurred, and proper arranging of the bed and body clothing, the patient may have some nourishment if she desires, and should have if she needs it.

Rest. In the great majority of cases, a few hours' sleep will be the most important restorative, and, therefore, means that conduce to this end should be used. Generally a quiet room and moderately darkened will be all that is required; but in some cases there are such restlessness and nervous excitement that an opiate must be given. So, too, if after-pains are so severe and frequent that she cannot sleep, and external applications, *e. g.*, of cloths wrung out of hot whiskey, with compression of the uterus, fail to relieve, opium and camphor, or antipyrine, may be given; quinine in a dose of ten grains is used by some practitioners.

The practice which old obstetricians had of preventing a woman's sleeping during the first hours following labor, lest flooding might occur, had no just foundation either in reason or in experience.

Of course, visitors are not admitted, and if the baby's cries disturb the mother it should be taken for a few hours into another room. She should lie the first few hours chiefly upon her back, and then occasionally upon either side, for it is better she should not be restricted to one position.

The question as to absolute rest in bed for some days after labor is not a new one. Sydenham's wise observation taught him that of those who died after childbirth the result in the great majority of cases was from getting up too soon, and he said he did "not suffer a woman to get up before the tenth day." That sagacious and successful obstetric practitioner, the late Dr. Churchill, stated that for one evil result from an error in diet he had seen ten from assuming an upright position or leaving the bed too soon. White,[2] on the other hand, had the puerpera sit up in bed a few hours after delivery, and the sooner she got out of bed the better; this was not to be deferred beyond the second or third day. Goodell had the patient sit up the day after labor, while her bed is making; this sitting up is repeated once or twice a day, until the fourth or fifth day, when she, if so disposed, gets up and dresses herself. Solovieff[3] sustains the practice of Goodell.

Runge,[4] who insists upon the woman remaining in bed at least nine days, says that in the first two days she should be upon her back, and then cautious movements and the side position are permitted. Sitting in bed, for example, while

the conclusion that by the act of couvade the husband accepts the paternity of the child, declares himself its author, and symbolizes by his acts that his conduct is directed by a desire for its prosperity, and the attention given him by his wife and friends is an acknowledgment that they recognize his claims and facilitate his design."

[1] The following statistics of one of the residents during my term of service in 1889 are here introduced, having been omitted in their more appropriate connection. They show that injuries of the perineum in childbirth are more frequent than practitioners who never make examinations after labors assert.

PHILADELPHIA HOSPITAL, March 12, 1889.

DEAR DR. PARVIN: I am very happy to send you the following report on the condition of the perineums in the last one hundred primiparæ and last one hundred multiparæ delivered in the maternity department:

Primiparæ:	Perineum intact,	58	Multiparæ:	Perineum intact,	84
	Lacerated,	41		Lacerated,	16
	Episiotomy,	1			
		100			100

Very respectfully, F. W. TALLEY.

[2] Treatise on the Management of Pregnant and Lying-in Women.

[3] Archives de Tocologie, February, 1881.

[4] Lehrbuch der Geburtshülfe.

nursing, eating, and urinating is positively forbidden during the first five or six days.

While some nurses and doctors think that the sooner a woman after confinement is up and dressed, apparently well, the greater their credit, it must be admitted that very seriously injurious consequences of too early getting up may not be immediate but remote, such as uterine displacement or subinvolution, and that prolonged rest is a less evil than the former; better keep a woman in bed a week too long than have her get up a day too soon. Again, every woman is a law unto herself; one may convalesce much more quickly than another, and uterine involution be more rapid. The condition of the patient is a better criterion as to the fitness of getting up than the number of days after labor; so, too, the effect produced by being up ought to be considered in deciding as to permitting it to be continued, and, therefore, if, for example, the woman has a return of the red lochia, or if abdominal pain be caused, the indication is very plain for immediate return to bed. It is probably best for most women not to sit up out of bed until ten or twelve days have passed, and then only for a short time, though sitting up in bed while taking their meals may be permitted in most cases after the third day; it is better for the puerpera to remain in her room for at least three weeks.

Food. In regard to this question the most diverse opinions have been held. Dionis referred to the popular notion of his day, that a woman has lost so much blood in labor, and so much, too, is lost by the lochia, she ought to eat more abundantly than at any other time, in order to repair the loss, and condemned it, because the woman was in "a state of fever," and the fever was sure to come on the second or third day. Dewees would not allow any animal broth until after the fifth day, or any animal substance until after the fifteenth; he gave for the first few days oatmeal gruel, tapioca, sago, mush and milk, rice and milk, tea, coffee, or very thin chocolate. In recent years, however, there has been a reaction against the absolute diet once insisted upon by obstetricians. But there is a just mean between famishing and feasting, between restricted and generous diet, which the practitioner will best follow. Those who have seen how well a patient, upon whom ovariotomy has been performed, gets on for the first few days with water, barley-water, and lime-water and milk, will hardly believe that the puerpera on the first day needs either chops for breakfast, or abundance of roast beef for dinner, but rather that she will convalesce more rapidly if liquid food is chiefly given. Indeed, her often temporarily enfeebled digestion and her little desire for solid food point very plainly to proper dietetic practice; her thirst is usually much greater than her hunger. At this time the simpler articles of food, such as tea and toast, the lighter animal broths, milk toast, or soft-boiled eggs will be most acceptable; let her gradually resume her usual diet. On the other hand, there are women whose digestion is perfect, and whose appetite from the first craves more liberal nourishment, and there can be no objection to giving them, from the beginning, the more easily digested animal foods. Or again, there may be a patient so greatly exhausted that beef-tea, milk-punch, or eggnog must be given at frequent intervals. There-

fore, no absolute rule as to the diet of the first days can be given; each case must be judged by itself, and the food directed according to the condition. Cold water will usually be found the most acceptable drink, and can be given at frequent intervals. If, however, the secretion of milk be too abundant, it can be diminished by lessening the quantity of fluids taken, and under these circumstances it is well to have the patient quench her thirst by pieces of ice rather than by copious draughts of water or of other fluid.

The Condition of the Bladder. The puerpera should be directed to empty the bladder twelve hours after delivery, for unless so advised she may be unconscious of the accumulation of urine, and it may continue until the organ is so greatly distended that spontaneous evacuation is impossible, even in case there be no obstruction of the urethra from swelling. If urine is not passed within twenty-four hours, the catheter must be used, and its use repeated in from eight to twelve hours until the patient recovers the lost power; the instrument must be carefully disinfected before and after use, and the parts adjacent to the urethral orifice washed with an antiseptic solution, *e. g.*, 5 per cent. solution of carbolic acid, before the instrument is introduced, for a cystitis may result from neglect of these precautions; in some instances the inflammation passes from the bladder to the ureter and the kidney. In order to run no risk of carrying from the external genitals septic matter into the bladder, it is advised by some to trust to sight and not to touch in catheterization; but unless the nurse uses the instrument, this is not expedient. In some instances there is dribbling of urine from a very full bladder, and both the patient and nurse insist that the organ is completely emptied when in fact it contains a large amount of urine; in all doubtful cases the practitioner should carefully palpate the abdomen, and if doubt remains remove it by introducing the catheter. By abstaining from the use of the catheter, unless the indications are plain—a distended bladder and suffering, and inability to empty it, notwithstanding external applications and moderate pressure—we have the best prophylactic of puerperal cystitis.[1]

Condition of the Bowels. On the third or fourth day a free alvine evacuation is to be had either by a warm-water enema, by a dose of calcined magnesia, by Rochelle salts, a Seidlitz powder, liquid citrate of magnesia, one of the mineral waters, as Hunyadi Janos, or by castor oil, which remains, notwithstanding all prejudices and reproaches, one of the safest and most certain laxatives for the puerperal woman. In case she does not nurse her infant a saline is preferred, as the watery operation to some extent lessens the determination of blood to the mammary glands. After the first free evacuation the bowels should be moved every day, or every other day.

The Lochia. Care of the External Genitals. Vaginal Injections, etc. Napkins or antiseptic pads are usually applied to receive the lochial flow; if the former, they should be sprinkled with a warm antiseptic solution before application, or absorbent cotton, prepared as has been stated, may conveniently replace the latter. Kaltenbach advises

[1] Schatz, of Rostock, advocates in ischuria which persists in lying-in women, dilatation of the urethra to an extent admitting the little finger—rarely, a second dilatation is necessary.

either cotton or jute, which after use may be burned. During the first week the external genital organs are to be bathed twice a day with a warm antiseptic solution, *e. g.*, 1–2 per cent. creolin mixture in water, and if there be the least offensive odor of the lochia a similar solution should be injected in the vagina twice or oftener in twenty-four hours; but unless there be this indication vaginal injections are not given. Raw surfaces at the vaginal entrance or upon the external genitals are to be carefully and gently washed twice a day with the creolin mixture, and then they may be dusted either with iodoform or with one part of salicylic acid and ten of starch. Sponges should not be used in bathing, but absorbent cotton or perfectly clean cloths, the cotton or cloths being afterward burned. The temperature of the room should be from 60° to 65°; the room must be well ventilated, but the patient is to be protected from drafts of cold air; all soiled clothing, napkins, etc., and urinary or fecal evacuations must be promptly removed so as not to poison the air by their exhalations. While care is taken that the patient is not chilled, the active state of her skin making her peculiarly susceptible to any sudden reduction of temperature, she ought not to be so carefully and heavily covered with bed-clothing as to make her uncomfortable and increase the perspiration. The room is generally kept moderately darkened, in the interest of the mother to promote her rest, and in that of the child to prevent the supposed injurious effect of light upon its eyes.

Changes in the clothing of the puerpera are made from day to day as cleanliness and comfort require; it is important that all clothing, and especially garments that come in direct contact with the skin, be dry and warm, though few would direct the method to secure this end advised by Hubert.[1] The exclusion of visitors during the first week materially assists in the convalescence of the patient.

Lactation. Moralists and obstetricians agree in urging the importance of the mother nursing her infant.[2] As a rule, she thus best secures her own and its health, she obeys nature's law and design, promotes the closest mutual attachment, and has an important influence in fashioning the first mental and moral development of her offspring. The prevalence of wet-nursing has been said to be the proof of a people's decline. Maternal nursing was once held in such high honor by some of the Romans that it appears no greater praise could be inscribed upon a

[1] Hubert says that the chemise should be worn a day by the mother or the sister, or placed during a night in the husband's bed, before she wears it. Upon the page containing this suggestion he narrates from Dionis the well-known story in regard to Clement using for the dauphiness after her first labor the fleece of a black sheep, this fleece being placed just after its removal from the living animal upon the naked abdomen of the puerpera, and his not using it in her subsequent confinements. The butcher brought the fleece carefully folded in his apron to the bedside of the patient, but unfortunately had left the door open, and the fleeceless sheep, bleating and bloody, followed him, greatly to the consternation of the dauphiness and of the ladies present; this accident prevented the repetition of the remedy. Clement's and Hubert's practice may be placed side by side.

Another curious fact is related by Dionis which shows that a medical sect of the present day have at least an illustrious example in the belief that odors, as flowers, have an unfavorable effect upon the sick. "It is claimed that odors have a very injurious influence at this time; and persons who are perfumed are not allowed to enter the room of princesses or of ladies of rank. In the case of the dauphiness, the usher had orders to examine the ladies who came, and to send away any who were perfumed or had flowers." Traité General des Accouchements, 1718.

[2] The late Mr. Darwin, in his Descent of Man, suggests the probability that during "a former prolonged period male mammals aided the females in nursing their offspring, and that afterward from some cause, as from a smaller number of young being produced, the males ceased giving this aid; disuse of the organs during maturity would lead to their becoming inactive."

mother's tomb than that found, according to Hubert, upon the tombs of many women dying in Hadrian's time: *Filios suos propriis uberibus educavit.*

In the *Spectator*, No. 246, there will be found an excellent article by the celebrated essayist, Steele, advocating maternal nursing. So, too, in Richardson's *Pamela* there is a valuable discussion of the subject. Surely, argument upon this theme is better than the Zolaism which infects so many novels now-a-days, and which even enters medical literature with needless pictures of woman's external sexual organs and her nude form, and such exhibitions are almost as odious as the egoism which parades upon every occasion, and without occasion, the photograph of the doctor!

Obstacles to the Mother's Nursing. Nevertheless there may be circumstances or obstacles arise which will forbid the mother nursing. First. The child may be illegitimate, and the mother, to hide her shame or to save it from disgrace, must part with it. Nevertheless it is better to nurse it during the first few weeks. Second. The poor quality or scanty secretion of milk may discourage the mother from nursing. But means may be used to increase the secretion and to improve the quality of the milk; and, at any rate, mixed nursing is better than a diet exclusively of artificial food—that is, let the child get all it can from the mother, then make up the deficiency by artificial food. Third. Vices of conformation of the nipple, or changes in the structure of the gland, the latter generally resulting from inflammation in a previous confinement, may render lactation difficult or impossible. Fourth. Diseases of the mother which are aggravated by nursing, or will injure the infant through the milk, forbid her nursing. Thus if the mother be exhausted by anæmia, or if she be suffering from phthisis, she ought not to nurse; indeed, a marked predisposition to the latter is a reason for not nursing, since the statistics of Flint show that in 13.5 per cent. of married women under forty years who are phthisical the disease is developed during lactation. If syphilis be recent, the mother should not nurse, for then the probability is the child is not infected; but otherwise, that is, if the mother was syphilitic when she conceived, or acquired the disease in the first half of pregnancy, she may. It is criminal to employ a wet-nurse for a syphilitic child.

As far as the infant is concerned, it may have been born prematurely, and be so feeble it cannot nurse at first; or it may be so deformed—as, for example, by harelip—or it may have been so injured in natural or in artificial delivery that it is unable to do so. In some cases the disability is only temporary.

Treatment if Mother does not Nurse. If a woman is not to nurse, let her have a less liberal diet until the secretion of milk disappears, and until then, too, a saline laxative may be given each day, beginning with the third; the breasts are covered with a layer of cotton-batting, which is to be frequently changed as it becomes wet with the mammary secretion or with that of the sudoriparous glands; in this, as well as in other cases, the gland may be supported when greatly enlarged by a properly applied handkerchief, the ends of which are tied over the opposite shoulder. Various popular as well as professional remedies have been recommended to stop the secretion of milk; among the former

may be mentioned a piece of flannel saturated with spirits of camphor applied to each breast, and among the latter iodide of potassium internally and belladonna locally. Generally all local treatment, except that which comforts the patient, is unnecessary, as the secretion stops if the milk is not required, for the great law of political economy is as true here as in the department of manufactures—if there is no demand, there will be no supply—and possibly some if not all the remedies advised to arrest the secretion have no more virtue than one which Mauriceau[1] mentioned as being employed in his day.

If the breasts are greatly increased in size, the application of a bandage is important; it contributes to the patient's comfort, and in lessening the supply of blood by compressing the breasts, of course diminishes the secretion of milk.

Care of the Breasts in Nursing. In case the mother is to nurse, the child is not put to the breast until twelve hours after labor. Some advise the first application to be made as soon after delivery as the woman has had the necessary attentions, while others would wait until the secretion of milk is established, alleging that an earlier application is vain in securing nourishment, that it wearies the mother and renders her more liable to sore nipples. Immediate application is to be rejected because the mother is so fatigued and needs rest, and a late one because of the difficulty of the child's nursing then, from the breast being so swelled that the nipple cannot be readily seized by it. While it is true that the infant gets little nourishment during the first twenty-four or forty-eight hours, yet it does get the colostrum which nature seems to have designed as a suitable laxative; moreover, it is usually satisfied with it, and is saved from having its stomach filled with improper food. It is probable, too, that the early and frequent removal of the contents of the breasts not only secures a proper formation or drawing out of the nipple, but also leads to a gradual secretion of the milk, and thus local and constitutional disturbances from this cause are prevented. Certainly, if we follow the rule observed by the young of inferior mammals, the child will be put to the breast within a few hours after birth: but the rule of twelve hours, as given above, is better.

The breasts are carefully protected from cold by covering them with soft flannel or linen, which much be changed when it becomes moist. The infant, as a rule, should not be applied to each breast at one nursing, but to them alternately, thus giving the nipples as long a rest as possible between the times of nursing, until liability to inflammation has passed. The infant must not be allowed to sleep with the nipple in its mouth, for then it sleeps and sucks alternately, and its digestive organs, kept in almost constant exercise, are liable to become disordered; this practice is very fatiguing to the mother, and the nipple being kept constantly moist and heated, softening and desquamation of the epidermis follow, with consequent erosions and fissures of the nipple, and thus the doors are opened for the entrance of germs, causing, finally, inflammation of the breast.

[1] "I know some women who held it for a very great secret, and most certain to drive the milk effectually back—and that is, to put on her husband's shirt yet warm, immediately after he had taken it off, and wear it until the milk be gone." (Op. cit.) Of course, the value of the remedy is indicated in the last words, "wear it until the milk be gone."

Before and after each nursing the nipple as well as the mouth of the child should be washed with clean water, and twice a day a little cocoa butter may be applied to the former; if it becomes sensitive, and especially if the slightest rawness or excoriation[1] appears, the surface may be pencilled once or twice a day with compound tincture of benzoin; if this treatment does not suffice, there may be conjoined with it, lightly touching the tender surface, a twenty-grain solution of nitrate of silver, and the use of a nipple-shield—the best is Needham's; after the application of the tincture of benzoin the nipple is left exposed until the tincture dries, and especially there must be no lint or a rag placed upon the surface, which of course can be removed only with the greatest difficulty at the next nursing.

Boric acid in a 3 per cent. solution has been employed as a lotion, and also used for saturating compresses laid upon the nipple in order to prevent mammary inflammation; the success was certainly great. A very weak solution of corrosive sublimate, as advised by Tarnier, has also been employed with somewhat greater success.[2]

During the first two or three days the infant, if comfortable, sleeps almost all the time, and once in five or six hours is as often as it needs to nurse; with the perfect secretion of milk the intervals must be shortened to two or three hours, endeavoring, however, to have the child nursed only twice in the night, so as to secure the mother as long periods as possible of uninterrupted rest. The infant ought to get an ample supply from nursing fifteen to twenty minutes; if it continue nursing longer, there is almost certainly insufficient secretion of milk.

Agalactia. If the milk be scanty, it may in many cases be increased by giving the patient a liberal diet,[3] especially by having her take animal broths, chocolate, and milk freely; if the last can be drunk at the temperature it is furnished by nature, it is best; some women find that malt liquors increase the flow of milk when all other means have failed, and only under those circumstances may they be advised.

Various galactagogues have been recommended, such as the leaves of the castor-oil plant applied to the breast, and drinking certain vegetable infusions, as of anise and of fennel; faradization of the breasts has in some cases produced remarkably beneficial results. Kaltenbach says that the laity attach great importance to the so-called milk-powder: Pulv. sem. fœnicul., cort. aurant., sacch. alb. āā. g. 2, magnes. carb. g. 4. But these are not to be compared with suitable and sufficient food conjoined with regular rest and as entire freedom from care as possible, the use of moderate but not fatiguing exercise in the open air, and avoidance of anxiety; mental worry, bodily fatigue, and loss of sleep notably lessen the supply of milk.

Galactorrhœa. Galactorrhœa may occur when there is polygalactia or excessive secretion of milk, and also when the secretion is normal in amount. As usually seen in the puerpera it is the former variety of the disorder, is only temporary, and generally yields to moderate compression of the mammæ, a restricted diet, and saline laxatives.

De Sinéty refers to cases in which the supply of milk is so abundant that several infants could be nursed, and weaning does not arrest the exuberance. Very

[1] At the maternity, Brussels, Hagermann advises in excoriation or fissures of the nipple 1 part each of tincture of benzoin and of balsam of Peru, and 8 parts of simple cerate.

[2] See Pingat's monograph, De la prophylaxie des abcès du sein.

[3] An objection has recently been made to milk, on the ground that it acts as a diuretic, and does not increase the mammary secretion.

great inconvenience results from this condition, for the breasts are painful and the constantly flowing milk requires several napkins a day for its absorption; finally the subject may become exhausted by the discharge, a condition formerly called *tabes lactea* resulting. Marvellous stories have been reported, especially by Puzos,[1] as to the abundance of the secretion of milk. Borelli stated that a nurse had so great a supply she not only suckled two infants, but sold a large quantity to an apothecary who from it made butter for the phthisical. Ridley, a physician, said of his wife that she nursed twins, several small puppies, and then had enough milk escape from her breasts in twenty-four hours to make a pound and a half of butter.[2]

Diagnosis of Recent Delivery. Very important questions in medical jurisprudence may arise in connection with childbirth. One of these relates to the evidence of recent delivery. If a primipara, the fragments of the torn hymen will be visible at the entrance of the vagina; the frænulum will almost invariably be found torn, and very probably more extensive injury to the perineum; the external genital organs are swelled, red, sensitive to the touch, and show various recent injuries; there is a bloody discharge from the vagina, and this organ will have injuries involving its mucous membrane, its rugæ are absent, and its calibre is so much increased that the hand can be introduced. In multiparæ all these signs may be wanting except the discharge and the capaciousness of the vagina, and the absence of rugæ, though there will be almost always swelling and redness of the external genitals. The uterus is a round, hard body, readily felt by abdominal palpation; the abdominal wall has its central line of pigmentation, and laterally the bluish cicatrices of pregnancy may be seen, while if the woman be a multipara white cicatrices are usually found. The breasts are swelled, the areola discolored, and colostrum or milk may be pressed out of the nipple. After seven or eight days external injuries of the genitals will be healed, but the lochial discharge remains, and the characteristic striæ and the pigmentation may be observed upon the abdomen and the breast; the uterus will be found enlarged. Kormann states that after the third week the question of recent delivery can hardly be answered with certainty. When the delivery was premature the difficulty increases with the length of time that may have intervened before the completion of pregnancy, and if there are no external injuries the diagnosis will chiefly rest upon the lochial discharge and upon the increased size of the uterus.

May the second stage of labor be so rapid in its progress or so sudden in its termination that a woman is taken by surprise, as it were, so that she cannot lie down upon the bed or on the floor, and the child, born while she is standing, falls on the floor, receiving serious or fatal injury? Kleinwächter's answer is, that it may happen with a multipara whose soft parts are greatly relaxed and offer little resistance, the labor-pains very strong, the basin of normal width, or somewhat greater, and the fœtus of the usual size; for several cases of this accident in which there was no question of medical jurisprudence involved have occurred. He regards it, however, as hardly possible in the case of a primipara. Yet it may be conceived as not impossible that a primipara alone, or without any intelligent person being present, may be deceived by the factitious desire to empty the rectum when the child's head is very low down, causing her to leave the bed for the water-closet, and the child being born there perish for want of proper immediate attention. Again: May a woman give birth to her child while she is in bed, and she be in such condition that the child perishes for want of proper attention, smothered it may be by the bed-clothes or in consequence of its face falling directly into a pool of liquid between the mother's thighs? The answer generally made to this question is that such an event may happen in the case of a primipara, but not in that of a multipara. Yet it would be going too far to say that while exceedingly improbable in the case of the latter, it is necessarily impossible.

Attentions to the Child. The care of the infant immediately after birth in case it should be in a normal condition has been considered.

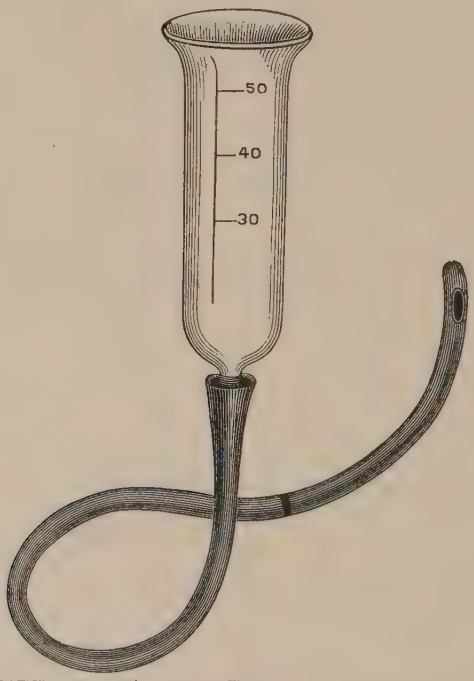
[1] Traité des Accouchmens. Paris, 1759.

[2] It would appear from these illustrations that it is possible for a wet-nurse, contrary to the opinion expressed in a recent poem, "Glenaveril," to be a *table d'hôte*.

But if labor be premature or from other cause the infant is very feeble, it may be necessary to postpone the washing and dressing, and simply wrap it in warm cotton and surround it by bottles of hot water, or use other means to secure for it a normal temperature; it is then too feeble to suck, and must be fed with milk from the mother's breast for some days.

The results which have been attained in Paris by means of the *couveuse* and *gavage* in prematurely born infants are very remarkable. By these 30 per cent. of children born at six months have been saved, 63.6 per cent. of those born at seven, and 85 7 per cent. of those born at eight months. The *couveuse*, or incubator, will rarely be used outside of maternities; its purpose being to secure for the infant a uniform temperature of 85°–95° F., this end must be obtained in private practice by the means previously suggested. But gavage is available to the practitioner. The apparatus used by Tarnier is shown in the subjoined illustration. The practitioner can easily improvise a simpler apparatus; all he needs is a small glass funnel to which a rubber tube is attached—the red rubber cathe-

FIG. 153.



TARNIER'S APPARATUS FOR THE ARTIFICIAL FEEDING OF PREMATURE OR FEEBLE INFANTS (GAVAGE); LUER'S MODEL.

ter is advised. The food being ready, preferably milk from the mother's breast, the infant is placed, with its head slightly raised, upon the knees of the nurse; the free end of the tube is moistened, then passed to the base of the tongue, and the infant by the instinctive efforts at swallowing will carry it to the entrance of the œsophagus, when the nurse by gentle pressure pushes the end into the stomach; the distance is about six inches from the part which enters the mouth to that which is in the stomach. The milk is now poured into the funnel, or receiver, and gravity quickly carries it through the tube into the stomach; the tube must be promptly withdrawn after the funnel is empty, lest the child vomit. The

quantity and the frequency of the feedings will depend upon the age and strength of the infant. A very feeble infant, born some time before the end of pregnancy, must be fed every hour, and between two and three teaspoonfuls of milk given at each meal. (This description has been condensed from Tarnier's directions.)

Discharges from the Bladder and Bowels. Some time in the first twelve hours the infant usually urinates. The urine during the first few days has a low specific gravity, and is quite pale. Apparent retention is generally non-secretion; for when the infant takes little or no food the quantity of urine secreted is necessarily very small. If there be actual retention and no urethral obstruction, a warm bath, followed by the application of cloths wrung out of warm vinegar to the hypogastrium, has been recommended; the use of the catheter is very rarely necessary. Meconium, so named from its resemblance to the juice of the poppy, is usually passed a few hours after birth; but if the anus be not imperforate, a delay of a day or two in this evacuation need give no anxiety; in case of longer delay a simple enema of warm water or of flaxseed tea may be used, or a little sweet oil given by the mouth. The third or fourth day the meconium usually disappears from the stools, and these gradually become a light canary-yellow.

The Umbilical Cord. In three-fourths of infants born at term the stump of the umbilical cord falls off within five days, but in premature infants the time is longer.

Ahlfeld has recently employed secondary section of the navel cord, and the prevention of disease of the navel and adjacent parts he believes is thereby secured. His method is, the third or fourth day after birth, to cut off the stump of the cord, it previously having been disinfected; the cut surface is sprinkled with boric acid.

The raw surface left by the detachment of the cord does not cicatrize for eight or ten days; it may be washed daily with carbolized water, and afterward a carbolized ointment applied, or it may be dusted with calomel or with a simple absorbent powder.

Umbilical Hemorrhage or Omphalorrhagia. It has sometimes happened that a woman has given birth to her child while standing, and the infant falling to the floor the cord has been torn, or a similar tearing has occurred in forceps delivery, the cord being abnormally short, and in either case more or less serious hemorrhage may follow. But the most frequent variety of umbilical hemorrhage observed is that which may happen several days after the birth and subsequent to the detachment of the cord. In forty-one cases collected by Minot[1] the average time was eight days; in four the hemorrhage began before the separation of the cord, in three immediately after, and in the others at periods varying from one to thirteen days. Grandidier, quoted by Marduel,[2] states that in one case it did not begin until the fifty-third. In a large proportion of cases jaundice was present; in some the hemorrhage was evidently dependent upon a hemorrhagic diathesis. The prognosis is quite unfavorable, for a great majority die in a time varying from a few hours to some weeks. In the treatment

[1] American Journal of the Medical Sciences, 1852.
[2] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, vol. xxiv.

it is useless to trust to astringents and compression. The only plan which holds out hope of success is to pass a harelip pin or a needle through the skin of the umbilicus upon one side, then beneath the bleeding surface, and have its point emerge from the skin on the opposite side, and a second pin is passed beneath and transverse to the first; a figure-of-8 ligature is made around the projecting parts of each pin, and the entire mass ligated. The pins are removed on the fifth day, but the ligatures are undisturbed and left to fall off with the ligated mass.

Secretion of Milk. The enlargement of the breasts in male as well as in female children, which with secretion of milk is sometimes observed a few days after birth, has been mentioned. This irritation almost always spontaneously disappears in two days; probably suppuration does not occur except in those cases in which the organ has been accidentally bruised, or if injudicious nurses have rudely squeezed it in efforts to force the fluid out.

Changes in the Shape of the Head—Caput Succedaneum—Cephalhæmatoma. The alterations in the form of the cranium occurring in childbirth disappear in the course of a week, or a somewhat longer time, and Nature is quite able to restore the original form without efforts on the part of the physician or the nurse to mould the head. The caput succedaneum, unless very large, usually disappears in a few days, and meantime, if anything is done, it may be occasionally bathed with a solution of muriate of ammonium. It is only rarely that suppuration occurs, and then if the collection of pus be large it must be opened. In cephalhæmatoma absorption may occur in from ten to sixty days; suppuration is an occasional consequence, and recovery may follow the discharge of the matter; but sometimes necrosis of the bone and even perforation, with resulting hernia of the brain, are observed. Bouchut suggests in case of a large tumor which does not diminish in ten or twelve days under the application of a solution of muriate of ammonium, or of camphor, or of an alcoholic mixture, the evacuation of its contents by an aspirator.

Winckel from the sixth to the eighth day incises the tumor, unless it is quite small, following the incision by pressure on the detached periosteum with salicylated cotton; cure occurs in a few days. If an abscess forms, it is opened, the cavity washed out with one-half per cent. creolin mixture, and gentle compression with salicylated cotton, previously advised, employed.

Changes in the Skin of the Newborn—Desquamation—Jaundice. About the third day after birth desquamation of the epidermis begins, and usually ends within a week.

About two-thirds of children have what has been called physiological jaundice, first appearing two to four days after birth, and continuing for a week or ten days. This is more marked in feeble infants, in those born prematurely or who have been exposed to cold, as is the fact frequently in foundlings. Various explanations have been given of the affection, but none is satisfactory. Active treatment is not indicated, as spontaneous recovery occurs.

The grave form of jaundice, or pathological jaundice, often septic in

its origin, is generally, if not always, fatal. It is also more frequently observed in children born with pelvic presentation.

According to Hofmeier,[1] every infant lives for a time upon its own organism on account of insufficient nourishment being provided immediately after birth; this is accompanied with degeneration or decomposition of albumin and red corpuscles. Bile-pigment is formed from the pigment of the latter. At the same time the activity of the intestinal canal causes a great increase in the amount of bile secreted, so that the quantity is larger than that excreted after a certain degree of intensity has been reached, and icterus neonatorum results, or, if the skin be not colored, bile may be found in the urine.

Bouchut[2] regards hepatitis, of which one of the manifestations is jaundice, as very common in the newborn, its causes being compression of the body, or contusion of the liver in labor, the impression of air upon the external surface, and umbilical phlebitis caused by ligating the cord, and extending to the hepatic veins. In eight or ten days the jaundice disappears.

Winckel adopts Birch-Hirschfeld's opinion that in consequence of swelling of Glisson's capsule, resulting from lessened pressure in the portal system following division of the cord, the bile-ducts are compressed, and therefore the jaundice.

But in the malignant form of jaundice there are fever, swelling of the abdomen, and tenderness in the right hypochondrium with enlargement of the liver; there may be nausea and vomiting, and in some cases epistaxis, purpura, or hæmatemesis. The respiration is difficult, hiccough frequent, and as M. Richard points out, when this state is prolonged or increases, a profound change of expression follows, the eyes are fixed, convulsions affecting the muscles of the face and of the limbs occur, the infant sinks into collapse, becomes cold and dies.

Bathing—Sleeping—Nourishment. An infant should have a bath once in twenty-four hours, in order to insure that perfect cleanliness upon which its health and comfort so greatly depend. It should not be accustomed to sleep in the nurse's arms, nor in the mother's bed, but in a separate one. As previously stated, it ought to be applied to the mother's breast twelve hours after birth. It ought, as asserted by Kleinwächter, to be subjected to a definite order in sucking from the beginning. After the secretion of milk has become abundant, generally the third day, "the child may be put to the breast every two hours, for at that time the capacity of the stomach is not great; after four or five days once in three hours, and at night there should be an interval of six or seven hours; later on six applications in twenty-four hours will suffice."

The child, as a rule, loses weight during the first few days; the loss is from 150 to 200 grammes, and is to be attributed to discharge of urine and of meconium, and also to the scanty supply of nourishment; at the end of the first week the child weighs nearly or quite as much as it did at birth.

The best proof of the good quality and of the sufficient quantity of the milk, whether of wet-nurse or of mother, is given by the thriving of the infant. If the child grows well, is plump and healthy, it must have good and abundant food; the old law, "by their fruits ye shall know them," is here quite applicable. Nevertheless, other means may be mentioned. When the infant is at the breast it can be known that it is getting milk readily by the movements of the cheeks alternating with those of swallowing; the last is often accompanied by a sound

[1] Kormann. [2] Op. cit.

which Hubert compares to that made in uttering the French word *glou-glou*. So, too, if the milk is abundant it is found in drops[1] at the angles of the mouth or upon the adjacent part of the cheek, after the child has finished nursing.

It sometimes happens that the mother has apparently a sufficient supply of milk, but its inferior quality is shown not only by the child's failing to thrive, but by disorders of digestion, attacks of colic, and the abnormal character of the stools. It may be that one, two, or three meals of artificial food each twenty-four hours will work a happy change in the infant's condition, and the mother, less worried and her rest less disturbed, and at the same time less frequently nursing the infant, secretes a better milk, and therefore she may continue to nurse, her deficient supply being thus supplemented.

Weighing the child from time to time is an excellent test of the quantity and quality of milk: the increase in weight ought to be about one ounce a day.

Selection of a Wet-nurse. The most desirable age for a wet-nurse is from twenty-two to thirty-five years. If a married woman, it is better that she should be a multipara, for the milk is then not only more abundant, but she is less liable to suffer from disease of the nipple, or mammary inflammation, and, moreover, has acquired useful experience in the care of an infant. If unmarried, she ought to be a primipara, for, as suggested by Hubert,[2] while the first fault might be excused, after the commission of a second there would be no guarantee that a third might not occur while she was nursing.

Delore states that from the time of Ambrose Paré blonde women were considered inferior nurses, and indicates that brunettes are generally preferred as habitually more vigorous. Dionis asserted that the best nurses were those of a sanguine temperament, and who have black or brown chestnut hair. Bad nurses were those of a bilious or melancholic temperament, and who have blonde or red hair.

She must be free from syphilis, tuberculosis, or exanthematous disease. There ought not to be a difference of more than two months between the birth of her own and that of the infant she nurses. The breasts should be of medium size, and the nipple free from excoriations, of such size that the infant can readily grasp it with its mouth, and the milk be easily drawn. As a rule, a woman who menstruates regularly ought not to be taken as a wet-nurse. Supposing everything favorable as to the supply of milk and the physical health, consideration should be given to her moral character and disposition, for while it is true that the milk of the nurse[3] can transmit no intellectual or

[1] The most gifted poetess of the century, if not of all centuries, Elizabeth Barrett Browning, has alluded to this where she speaks of the babe "knowing all things by their blooms, not their roots," etc.:

"And human love, by drops of sweet
White nourishment still hanging round
The little mouth so slumber-bound."

[2] The remark of Hubert suggests quoting the following observation by Goldsmith:

"For the first time the very best may err; art may persuade, and novelty spread out its charm. The first fault is the child of simplicity, but every other, the offspring of guilt."—*Vicar of Wakefield.*

[3] The belief that the milk which nourished the newborn had much to do with the formation of the character is an old one; even to this day it is not uncommon to hear one speak of having sucked in with his mother's milk certain beliefs or principles, especially those of a religious character; but the expression is used more as a figure of speech to indicate how completely and thoroughly those beliefs or principles are interwoven with his spiritual nature, having been taught him in the very dawn of his intelligent existence, than that they came by the nourishment derived from the mother. The famous Cato, however, did believe that affection might be thus com-

moral qualities to the nursling, yet it is also true that with the development of the infant's intelligence it will receive in its plastic nature impressions more or less profound and permanent from one with whom it is so intimately and constantly associated as the nurse. Moreover, the question as to her disposition is an important one, since for the time being she is to some degree a member of the family; taking the child to her own home to nurse is quite exceptional.[1] Further, it is generally admitted that the milk may at once undergo important modifications in consequence of profound mental emotion. Devilliers remarks that it would be easy to adduce examples of nurses in whom violent passions, especially anger, changed the qualities of the milk so as to disturb the health of the infant, and even cause severe convulsions. And he adds: "A thousand times better a woman somewhat stupid, of an impassive character and almost insensible to passions, than a nurse with intelligence more developed, but of a passionate and choleric character."

Artificial Feeding. In case the mother cannot nurse her infant, and it is impossible to obtain a suitable wet-nurse, artificial nourishment must be used. Condensed milk is a very convenient form of food, especially in cities and in hot weather, when it may be difficult to obtain pure milk from the cow. Babies like it, and rapidly fatten taking it, and they are free from constipation. The liability to rhachitis in children living on it exclusively has been stated by Fleischmann, Lusk, Galabin, and Starr. Runge remarks: "The condensed Swiss milk contains 39 to 48 per cent. of sugar, and therefore is not to be employed exclusively." The milk of the cow is that which, as a rule, can be best used for the nourishment of the infant; it has been the practice to select the milk from one cow; Winckel, however, advises that of several mixed together. In order to remove all possible infectious matter the milk ought to be boiled before using it; recently there have been invented apparatuses for sterilizing milk; milk after being subjected to this process may be kept for several days without change; the great lessening of infant mortality in hospitals since the introduction of sterilized milk is conclusive proof of its value.

Cow's milk, after sterilization, will be diluted with two parts of water that has been boiled, and sweetened with milk sugar, for the infant during the first four weeks. Then the proportion of water is gradually lessened until at the end of eight weeks equal quantities of water and milk are given. At four months the milk is given undiluted.

But cow's milk, even with these additions, differs from human milk, and various methods have been employed to make an artificial fluid of which the former is the base, which shall be more nearly like that which mothers provide for the infant. The following is a formula approved by Dr. Fullerton:

municated, for, according to Plutarch's statement, he had his wife, whenever she nursed her son, also give her breast to the infants of her slaves, so that sucking the same milk they might have an affection for him. Cruelty of disposition was also thought to be derived from the first nourishment. Thus among all the bitter reproaches which the deserted Dido cast upon the escaping Æneas, one of the severest, as indicating his cruel nature, was that he had nursed the breasts of Hyrcanian tigresses. Gardien quotes the statement that if young lions are nourished by cow's milk they are gentle, and, on the other hand, that if puppies are brought up by wolves they are fierce.

[1] This seems not to have been extraordinary among the Egyptians, as the story of Moses' infancy suggests.

Milk	f ℥ij.
Cream	f ℥iij.
Water	f ℥x.
Milk-sugar	℥vj ¾.

"Put in a flask in the steamer and steam for twenty minutes; then remove the flask from the steamer, and when still slightly warm add lime-water f ℥j. It may be placed on ice, and a sufficient quantity taken from it when needed."

Difficulty and Pain in Urinating. It occasionally happens that male children have great pain before, and some difficulty in urination; upon examination it will be found that the trouble arises from stenosis of the orifice in the prepuce. Of course, circumcision is a certain and permanent cure, but dilatation will also be successful, and it will generally be preferred; dilating may be done by drawing the prepuce over the closed blades of a suitable forceps inserted in its orifice, and then opening the blades until about one-half of the glans is exposed; cold water is applied for an hour, and the dilatation may, if necessary, be repeated after one or more days.

Thrush,[1] Sprue, Muguet. These different names are applied to an affection of the mouth of the infant characterized by the appearance upon the tongue and upon the inner surface of the cheeks, thence possibly extending to other or to all parts of the buccal mucous membrane, of small, white curd-like patches. The affection is much more frequent in the hand-fed than in the breast-fed, and is not so much a disease as indicative of a diseased condition of the mucous membrane and of the secretions, furnishing a suitable soil for the growth of the fungus, saccharomyces albicans, formerly called by Robin oïdium albicans. The occurrence of such a growth is usually an indication that proper care of the child's mouth has not been taken in regard to washing it, or that in artificial feeding either the food is not in suitable condition, or the vessel, the tube, and the nipple are not thoroughly cleansed. The best local application is borax; it may be used as a solution in water, twenty grains to the ounce, freely pencilled three or four times a day upon the patches, or, as advised by Winckel, a mixture in syrup may be used, of which half a teaspoonful is given one to three times a day, the child by the movements of its tongue making a better application of the remedy to the diseased places than can be done with a brush.

[1] Thrush, probably from the same root as thrust and sprue, spelled by some lexicographers sprew, from the same root as sprout.

PART II.

SECTION I.

THE PATHOLOGY OF PREGNANCY.

Introductory. The pathology of pregnancy includes:

First. The abnormal position occupied by the ovum completely or partially. Thus, if the ovum be outside the uterine cavity, it is out of place, a condition commonly known as extra-uterine gestation, but which has been more appropriately called by Barnes ectopic.

Further, the placenta, instead of having its site in the upper portion of the uterus, may in whole or in part be in the lower uterine segment, that is, be prævial.

These are the gravest deviations from normal pregnancy.

Following the consideration of placenta prævia, of which the dominant symptom is hemorrhage, that has been called unavoidable, there will be presented the subject of accidental hemorrhage, or bleeding from premature detachment of the placenta occupying its normal site.

Second. The woman may suffer from exaggeration of a physiological change incident to gestation, or disease of an organ may otherwise be consequent upon the pregnant condition; if she were not pregnant, neither morbid manifestation would occur. In illustration, the common nausea and vomiting of pregnancy may be so aggravated that peril to life is imminent. Again, albuminuria may be caused by gestation.

Third. The woman when she becomes pregnant may be laboring under some chronic disease, as pulmonary tuberculosis, or syphilis.

Fourth. Gestation does not exempt her from acute diseases; these, then occurring, as erysipelas, variola, scarlatina, cholera, pneumonia, etc., may be injuriously affected by the pregnancy, or on the other hand have a deleterious influence upon the latter.

Fifth. Diseases of the sexual organs are necessarily included in the pathology of pregnancy.

Sixth. Surgical operations, or injuries and accidents occurring in pregnancy, are to be considered.

Seventh. Diseases of the ovum make an important part of the pathology of pregnancy.

Eighth. As a result usually of causes included in some of these classes, the pregnancy may be arrested, and therefore such interruption, whether by abortion or by premature labor, must be here presented.

CHAPTER I.

ECTOPIC DEVELOPMENT OF THE OVUM OR OF THE PLACENTA.

ECTOPIC PREGNANCY—DEFINITION AND ETIOLOGY. The normal place in which the ovum is developed is the uterine cavity, and therefore if this development occurs in the tube, in the ovary, etc., the ovum is ectopic, that is, out of place, and the pregnancy is so called. While the causes, as Martin has said,[1] are obscure, this is true in general, for there are instances in which the etiology is certain, though in many others we must be content for the present with probable explanations.

1. The body of the uterus having been removed, impregnation may occur. This happened in a patient of Koeberlé, the uterus having been amputated because of a myoma; there was a fistula in the cervical cicatrix, and through this spermatozoids entered. Kaltenbach suggested that a similar event might happen in case of removal of the inverted uterus,[2] or after a Porro operation.

2. The ovum may escape into the abdominal cavity, from the uterus, through an opening in the latter which remained after a Cæsarean section; this occurred in a case reported by Lecluyse.

3. *Absence of ciliated epithelium from the tube.* This absence is explained as the result of catarrhal inflammation. Those who hold that impregnation normally occurs in the uterine cavity claim that these cilia by their movements toward the uterus prevent the spermatozoids from ascending the tube, but if they have been destroyed no obstacle is offered. On the other hand, admitting impregnation in the external portion of the tube, the belief generally held, ciliated action is necessary for the transfer of the ovum to the uterus. The result is the same, whichever theory is adopted.

4. *Narrowing of the tube.* The lessened diameter of a part of the oviduct may be the result of perimetritic adhesions, of twisting, of cicatricial contraction following inflammation, of a polypus, or of a fibroid tumor of the uterus in the vicinity of the uterine entrance of the duct.

5. *Impermeability of the oviduct.* An ectopic gestation thus caused must be explained by the hypothesis of an external migration of the spermatozoids or of the ovule after its impregnation. Thus, supposing an atresia at some part of one tube, the other being normal, the spermatozoids passing through the latter, the ovule liberated from the ovary of the opposite side is impregnated, and entering the other tube is arrested by the obstruction. Or, an impregnated ovule may, it is supposed, pass over to the opposite tube. But these explanations are chiefly hypo-

[1] Congrès Périodique International de Gynécologie et d'Obstétrique. Bruxelles, 1894.

[2] Müller reported a case of ectopic gestation in a hernial sac; A. Martin-Wendler, in the ampulla of a tube that after the extirpation of a cancerous uterus had been pushed into the vagina, and J. Veit a similar case.—Ahlfeld.

thetical, and there must in some cases be a doubt as to whether the closure of the tube preceded or followed the impregnation. The last observation also may sometimes apply to those cases in which intra-uterine migration of the ovum has been observed. In this migration the ovum entering through the pervious tube is found developed in the partially closed tube of the opposite side.

6. Accessory tubes and tubal ostia may be causes of ectopic gestation, as recently[1] maintained by Sänger.

Dr. Joseph Price, of this city, has had 108 cases of ectopic gestation, and all of them, he states in a recent communication to me, were primarily tubal with one exception, possibly two, the ovary involved forming part of the sac.

He regards the following as causes: "Catarrhal troubles and distorted positions of the pelvic viscera; emotional disturbance is no small factor."

The abnormal situation of the ovum has occurred in many cases after a period of sterility, or after an attack of gonorrhœa, or after a childbirth followed by pelvic inflammation. The great majority of cases are observed in women who have previously borne one or more children. Several cases are recorded of ectopic associated with normal pregnancy, and a few of double ectopic gestation.[2] It is quite possible that some of the cases reported as double ectopic gestation were really single, for hæmatosalpinx is not infrequent, affecting the tube not occupied by the ovum.

FREQUENCY. It is impossible even to approximate an accurate statement as to how often ectopic gestation occurs in comparison with normal pregnancies. The statements of authorities widely vary. Thus Winckel saw ectopic gestation in 16 cases to about 222,000 births, while Bandl had only 3 in 60,000 births; Ahlfeld speaks of only one case observed by him in twelve years at Giessen and Marburg, and, on the other hand, Dr. Price has met with so large a number of cases, as stated above, that he regards the accident as occurring once in 1000 pregnancies.

In arriving at a probable conclusion as to the frequency of ectopic pregnancy, it must be remembered that the late Matthews Duncan, justly as I believe, said, "There[3] are many cases in which the disease is never suspected; the fœtus dies, and is, so to speak, entombed." Kaltenbach speaks of hemorrhage into the tube which, in part with the ovum, finds its way into the abdomen, where the embryo is quickly absorbed, while the amnion itself and especially the chorial villi with their characteristic epithelium remain a longer time between the blood-clots. So, too, in some of the cases of tubal abortion in the first weeks, the developing ovum occupying a place near the pavilion, and expelled into the abdominal cavity by the contractions of the oviduct, it is quite probable the

[1] Monatschrift f. Geburtshülfe und Gynäkologie, January, 1895. It is of interest to observe in this connection that Kossmann states, Zeitschrift für Geburtshülfe und Gynäkologie, 1894, that accessory tubes and tubal ostia are found in 4 to 10 per cent. of women.

[2] One of the most remarkable explanations of an ectopic gestation is given in the Philadelphia Medical Museum, vol. i., new series, 1811. Dr. W. B. Smith, of Jamestown, Va., describes the autopsy of a colored woman, in which he found double ovarian pregnancy, one ovary containing a fœtus four inches, and the other one eight inches long. The tubes were diseased, so that the "male semen" could not have passed through either, and hence he suggests that impregnation resulted from the semen being taken up by the blood, and thus carried to the ovaries.

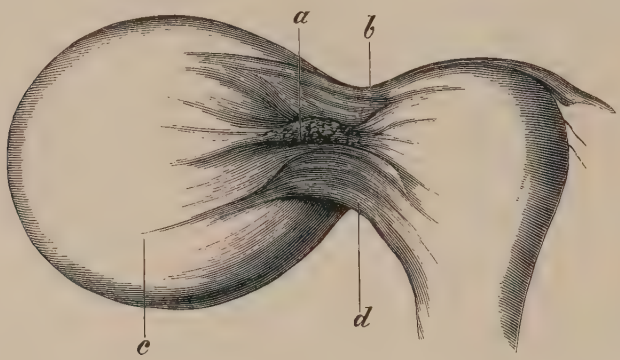
[3] London Lancet, July 13, 1889. The statement by Duncan, quoted above, is confirmed by Ahlfeld. If the fœtus "dies early, the sac may atrophy without the woman having any observable injury."

expulsion may take place without any serious symptoms, and the patient soon recover.

I therefore repeat the statement made in the second edition of this work, that probably there is one case of ectopic gestation to 500 of normal pregnancy. Those who make their estimates from abdominal sections and from post-mortem examinations probably omit of the entire number of ectopic pregnancies quite as many as they record.

Varieties. These are primary and secondary, and of each there are two. Primary ectopic gestation is either tubal or ovarian, with the subvarieties tubo-uterine, also called interstitial, tubo-abdominal, and tubo-ovarian. The secondary varieties are abdominal and subperitoneo-pelvic, or pregnancy in which the developing ovum is between the layers of one of the broad ligaments, the result of a ruptured tubal pregnancy.

Fig. 154.



Pregnancy in the External Third of the Left Tube. (After Winckel.)
a. Ovary. *b*. Left tube. *c*. Tubal gestation cyst. *d*. Adhesion.

Tubal Pregnancy. This is by far the most frequent variety of ectopic gestation. Some indeed contend that it is the only one, Dr. Doran, for example, stating that he is inclined to believe that all are tubal.

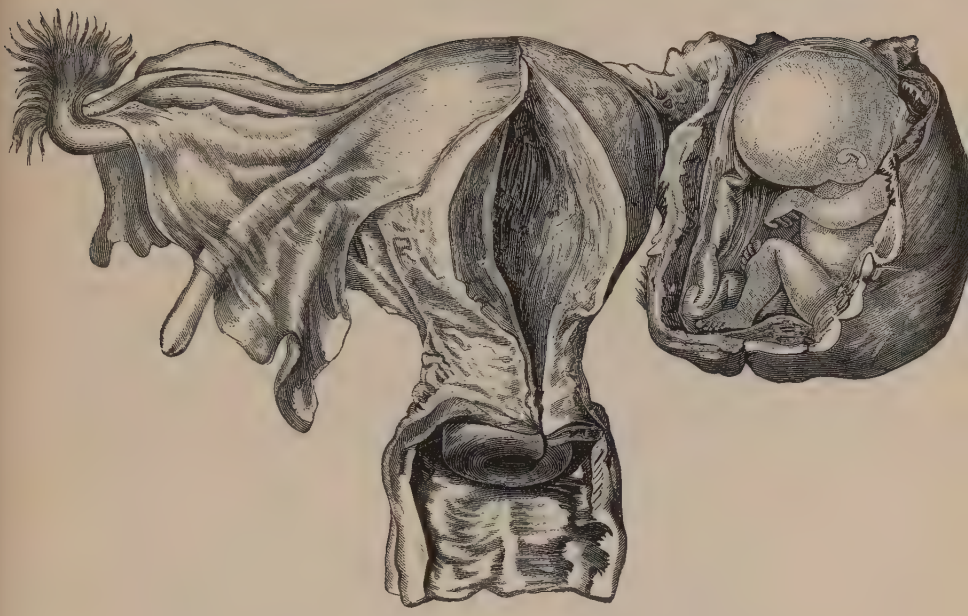
One of three events occurs: Tubal abortion, rupture of the tube, or completion of pregnancy; the second is the most frequent,[1] rupture generally taking place within six to eight weeks, and the last is the rarest. That the development of the ovum may continue until term is proved by a few cases, among them one of Spiegelberg's, and in publishing it he added five similar cases reported by others, and one reported by Dr. Joseph Eastman, of Indianapolis, in which he operated at term, saving both mother and child. Kaltenbach admits it, stating, however, that it is exceedingly rare.

Development of the Ovum in Tubal Gestation. The ovum[2] has the same deciduous membranes formed from the mucous membrane

[1] Abortion is about as frequent as tubal rupture, according to some observers. Orthman, indeed, Zeitschrift f. Geburtshülfe und Gynäkologie, 1894, of 124 cases of tubal pregnancy in the first four months, found 61 each of abortion and of rupture; in 2 each accident occurred.

[2] Lederer: Beiträge zur Anatomie der Tuberschwangerschaft. Berlin, 1888, and Berlin Thesis, by John von Glahn, 1888.

FIG. 155.



TUBAL PREGNANCY. RUPTURE OF GESTATION CYST. (From RAMSBOTHAM.)

of the tube that in normal pregnancy are contributed by the lining membrane of the uterus. The muscular fibrillæ of the tubes during the first two months hypertrophy, and then a retrogressive metamorphosis begins, caused by a pressure-atrophy from the growing ovum. The

FIG. 156.

ACTUAL VIEW OF PLACENTAL VILLA. (Drawn by E. TEICHELMAN from section made by BERRY HART.)
c. Encroaching upon and causing thinning of the muscular wall (*a*) of the Fallopian tube.
b. Maternal blood sinuses.

chorial villi, forerunners of the fœtal portion of the placenta, enter the connective tissue; their penetration into the muscular layer, observed in one case by Leopold, was not found in the examination made by Dührssen. The preceding illustration, Fig. 156, is from Tait's lectures on "Ectopic Pregnancy."

In Zucker's[1] case of tubal pregnancy rupture with fatal hemorrhage occurred when the gestation was only between two and three weeks. The rupture is generally into the peritoneal cavity, and very rarely between the layers of the broad ligament. In many cases the mother, unless saved by a surgical operation, perishes within a few hours. But if the rupture should occur in that portion of the tube not covered by peritoneum, the danger is much less, for the connective tissue uniting the two folds of peritoneum not yielding readily, in some degree restrains the bleeding, and its meshes facilitate coagulation. In the great majority of cases the embryo dies, and a hæmatoma results, which remains for a time; this may be gradually absorbed, or suppuration with the formation of an abscess occurs.[2] But in exceptional instances the develop-

FIG. 157.

FIG. 158.

DIAGRAMMATIC SECTION OF FALLOPIAN TUBE REPRESENTING THE TWO DIRECTIONS OF RUPTURE. 1. INTO THE PERITONEAL CAVITY. 2. INTO THE CAVITY OF THE BROAD LIGAMENT. (FROM TAIT.)

a. Clot at point of rupture. *b*. Wall of the Fallopian tube. *c*. Cavity of the broad ligament, with (3) folds separated by hæmic effusion, *a*.

ment of the ovum continues, and there is an extra-peritoneal, broad ligament, or intra-ligamentous pregnancy. The usual course of this pregnancy will be described hereafter.

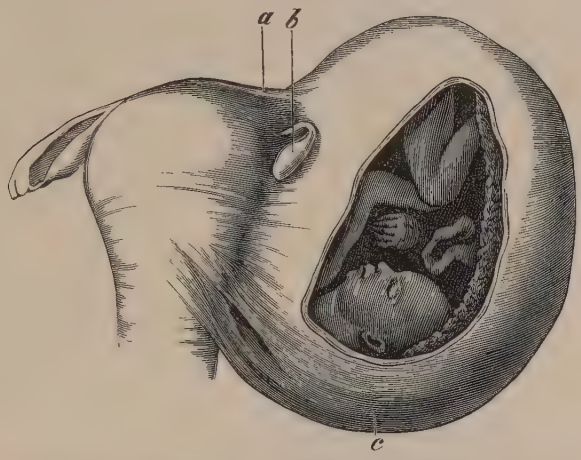
The possibility of a development of the ovum in the tube and ligament should be borne in mind; then there is a tubo-ligamentous pregnancy. Some authorities regard those rare cases in which a tubal pregnancy has gone to term as oftener instances of a gestation in

[1] Centralblatt f. Gynäkol., 1888.

[2] It is incorrect to speak of intra-peritoneal and extra-peritoneal hæmatocele. An encysted collection of blood in the peritoneal cavity is a hæmatocele, and a corresponding blood tumor in the connective tissue is a hæmatoma.

which the ovum occupies the tube and the space between the separated layers of the broad ligament. It would seem probable that as a rule, in such a variety originally of tubal pregancy, no violent rupture, such

FIG. 159.



PREGNANCY OF THE RIGHT TUBE. PARTIALLY INTRA-LIGAMENTOUS. (From ZWEIFEL.)
a. Right tube. *b*. Ovary. *c*. Gestation cyst.

as is represented in Fig. 158, occurs, but a gradual entrance of the ovum takes place.

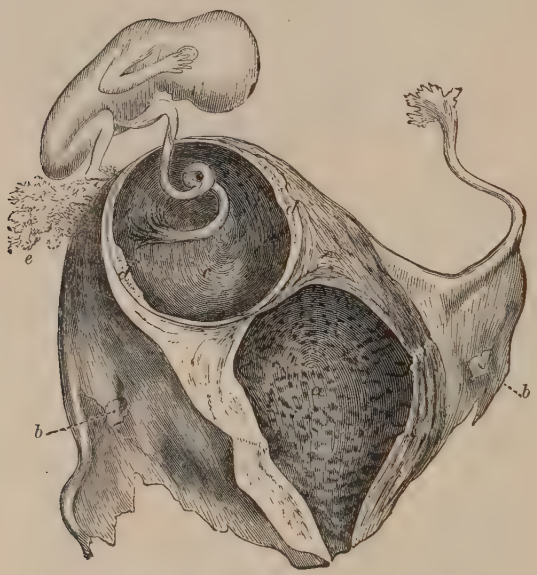
FIG. 160.

DIAGRAMMATIC REPRESENTATION OF INTERSTITIAL TUBAL PREGNANCY AT TIME OF RUPTURE. (From TAIT.)

INTERSTITIAL PREGNANCY. Mr. Tait asserts that this variety of ectopic gestation is uniformly fatal by primary intra-peritoneal rupture before the fifth month. The assertion, however, ignores the case of

Braxton Hicks,[1] which in the sixth month of pregnancy ended by the discharge of the fœtus through the natural passage; the placenta was retained, and four days subsequently violent pain occurred, and the patient died in two hours in collapse. The post-mortem proved that there had been an interstitial pregnancy, and that while the fœtus escaped through a rupture into the uterus, a subsequent rupture of the gestation cyst into the peritoneal cavity had occurred with fatal hemorrhage. It ignores the case of Maschka, in which a double rupture of an interstitial pregnancy took place, the body of the fœtus being extracted through the uterus, while the head escaped into the abdominal cavity. Spiegelberg has asserted that in rare cases the pregnancy may go to term, and there have been several cases reported in which the

FIG. 161.



TUBO-UTERINE, INTERSTITIAL OR MURAL GESTATION.

a. Cavity of uterus clothed with decidua. *b*. Broad ligament. *c*. Tubo-uterine sac which contained embryo. *d, d*. Thicker part of cyst-walls. *e*. Placenta.

ovum was entirely expelled through the natural passage. While confessing to skepticism in regard to many of these reported cases, in some denial of the accuracy of the statements made by reputable and able observers would be unjust. That such an event is frequent is in the highest degree improbable, independently of the fact that interstitial is an exceedingly rare form of ectopic gestation, and that many of the cases should be credited by the reporters and by the profession only illustrates the old adage that opinion travels the world without a passport.

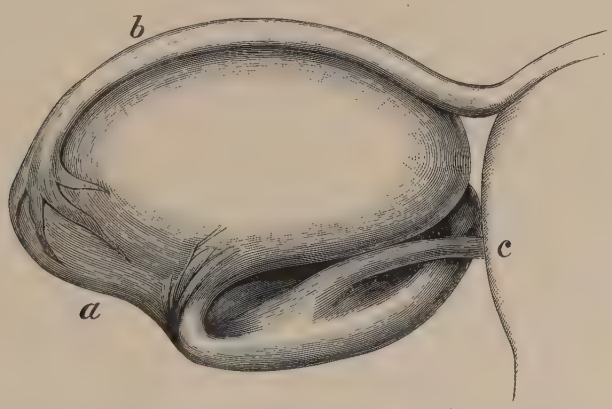
Interstitial pregnancies are more frequent in medical journals than they are in autopsies or in abdominal sections. Careful and impartial study[1] of reports

[1] London Obstetrical Society's Transactions, vol. ix.

of some of the unverified cases of interstitial pregnancy will convince any one that they were in all probability normal pregnancies, and meddlesome treatment caused abortion. It should be remembered that some of the best authorities regard the diagnosis of interstitial pregnancy impossible. A few years since a former pupil and medical friend in a distant city wrote me of a double interstitial pregnancy occurring in one of his patients; she was being treated by a gynecologist for subinvolution of the womb, the sound having been more than once introduced, and applications to the endometrium made. Miscarriage of one embryo occurred, and within a few days, of the second. Both of the medical gentlemen who examined the patient prior to the abortions were confident that the uterine cavity was empty, and they alike believed, after these occurred, that there had been double interstitial pregnancy.

OVARIAN PREGNANCY. This is very rare, but cannot be reasonably doubted after the cases of Leopold, Martin, Walter, Mackenrodt, and others. Martin's case, reported at the Brussels Congress, was one in which the subject of ovarian pregnancy had cancer of the cervix. The explanation of the origin of this form of ectopic gestation is that an ovisac rupturing the ovule did not escape, but through the rent in the follicle a spermatozoid entered and fecundation followed. The ligament of the ovary is distinctly shown and the tube does not participate in the formation of the gestation cyst.

FIG. 162.



OVARIAN PREGNANCY, LEFT SIDE, ONLY PART OF THE OVARY PARTICIPATES IN THE GESTATION CYST. (From WINCKEL.)

a. Ovarian pregnancy. *b*. Left tube. *c*. Uterus.

TUBO-OVARIAN. Tubo-ovarian pregnancy may result from congenital or acquired union between the abdominal mouth of the tube and the ovary; a cyst existing, the rupture of an ovisac into it, fecundation follows. Such pregnancy has in rare cases gone to term. The usual course of an ovarian gestation is that of a tubal pregnancy.

[1] That my skepticism in regard to some of the cases of interstitial pregnancy which have been reported is not peculiar is shown by the fact that Winckel has referred to one of them "as more than improbable," and some years before his death Dr. Fordyce Barker requested me to write a criticism of another, in which he was convinced that a normal gestation had been ended by abortion from the erroneous diagnosis of interstitial pregnancy. Yet both these cases, occurring in this country, are still quoted as true.

Abdominal Pregnancy. A primary abdominal pregnancy is denied by Mr. Tait on the ground that, even if an impregnated ovule drop into the peritoneal cavity, the digestive power of the peritoneum is so great that it would have no chance of development. Nevertheless, if spermatozoids can live for months in the abdominal cavity of the frog, is it not possible that an ovum may defy peritoneal digestion, and its development take place in the peritoneal cavity? Moreover, what happens to the embryo of a ruptured ovum does not necessarily occur if the ovum be intact. Hart and Carter, however, whose researches will be referred to in connection with intra-ligamentous pregnancy, state that a purely intra-peritoneal variety of abdominal pregnancy is yet to be demonstrated. Virchow said at a meeting of the Medical Society of Berlin that he could not believe with Olshausen that all extra-uterine pregnancies were tubal; that such an opinion was especially difficult to admit for large lithopædions, and that he had seen one lasting twenty-six years which was completely outside an intact tube.

What is called *secondary abdominal pregnancy* includes those cases in which an ectopic gestation cyst, usually tubal, at least primarily, opens into the peritoneal cavity, and the development of the fœtus continues. Mr. Tait asserts that this pregnancy results from rupture of an intra-ligamentous cyst. In such case there were two ruptures, one primary, that is, a tubal pregnancy becomes intra-ligamentous, and the other secondary, so that the latter, rupture again occurring, is converted into abdominal.

Kaltenbach suggests that some of the cases called abdominal are only partial—that is, tubo-abdominal.

Fig. 163.

Uterus and Fœtus in a Case of Abdominal Pregnancy.

It is generally stated that in abdominal pregnancy (Fig. 163) the developing ovum causes irritation of the adjacent parts, and a cyst is formed of pseudo-membranes. "In rare instances the cyst atrophies, or is not formed, and the ovum is free in the abdominal cavity; such

cases have been seen by Lecluyse, Matecky, Schreyer and others." If a sac is formed, it usually contains some muscular elements derived probably from the muscles of the subserous layer of the pelvis. The placenta has been found attached to the uterus, to the bladder, or to the ovary; "Sivard[1] has seen it attached to the mesentery and colon of the left side; Courtail to the omentum and stomach; Clarke to the kindneys and intestines; Tilt to a great part of the mesentery, mesocolon, portions of the small intestine, and to the two or three superior lumbar vertebræ; Baldwin, Wilson and Koeberlé to the anterior abdominal wall in the line of incision made either at the post-mortem examination or during an operation for gastrotomy."

Abdominal gestation lasts longer than any other ectopic form. In some instances the fœtus develops during nine months, then dies, and it may be retained for many months, or even many years; in one instance the pregnancy lasted fifty-four years; a still longer retention is given below.

The great danger of ectopic gestation, as has been pointed out, is hemorrhage, and if the patient does not die from this, subsequent peritoneal inflammation may lead to a fatal result.

The death of the embryo or fœtus, which is a favorable event in all ectopic gestations, is followed by changes similar to those which occur after death in intra-uterine pregnancy; but in addition to these changes the fœtus may be converted into adipocere, or into a lithopædion;[2] the formation of a lithopædion has been observed in pregnancy in a rudimentary uterine horn, the fœtus dying at five months. The most widely known of the last is the lithopædion of Leinzell, which was found in one of the tubes upon post-mortem of a woman ninety-two years old, who had carried it forty-six years. In August, 1883, Sappey presented to the Paris Academy of Sciences the membranes and fœtus which had been retained fifty-six years; calcareous incrustations were limited to the wall of the cyst, but the fœtus was in a natural attitude, and the skin, superficial organs and those of the cavities, the muscles, and in fact all parts of the body, preserved their consistence, suppleness, and normal color.

Inflammation and suppuration may occur in the fœtal cyst, ending in the discharge of the fœtus by the abdominal walls, by the bladder, the vagina, or the rectum. According to Mattei, the first is the most frequent; according to Parry, the last. In one instance the cyst communicated with the stomach; it was reported by Darby; "the cavity which contained the child had opened through the abdominal wall;

[1] Parry on Extra-uterine Pregnancy.

[2] Lithopædion, literally a stone child, is a name given to the fœtus when calcification has occurred. Barnes states that this change is limited to the membranes and sac, the shell thus formed preserving the fœtal structures but little changed. But this is only one of three forms. Kuchenmeister states (Archiv für Gynäkol., 1881) that the fœtus falling into the abdominal cavity, in consequence of rupture of the cyst, is mummified, and by degrees covered by a calcareous layer deposited immediately beneath the epidermis; this is a true lithopædion, and it is the second form. The third form is when an incrustation involves both the membranes and the fœtus. Sarraute (Archives de Tocologie, March, 1885), in a contribution to the microscopic study of lithopædions, states that most frequently all the cavities are found filled with calcareous salts, or salts derived from fat; the cartilages and bony cavities and the vertebræ are infiltrated with calcareous masses.

"The oldest known case of lithopædion is that reported by Sens, in 1582; it was carried twenty-eight years. This case inspired Rousset to make a curious poem, in which he presented the following questions: *cur nasci potuerit? cur per vigenti octo annos in utero retentus non putruerit? cur in lapidem obduruerit?*"—Maygrier.

when Dr. Darby enlarged the orifice and extracted the fœtus, immediately after the entire contents of the stomach emptied themselves into the cavity of the cyst through a ragged, jagged opening, two inches in width."

Intra-ligamentous Pregnancy. The origin of this variety of ectopic gestation has been given, and its possible termination in a secondary abdominal pregnancy by rupture into the peritoneal cavity, should the fœtus live, has been stated. While in a great majority of cases the embryo or fœtus perishes, the tube rupturing between the folds of the broad ligament, in a few pregnancy may continue for some weeks, the fœtus then dying and suppuration follow, or it may continue until term. The changes that occur in the developing ovum in regard to the peritoneum are of great interest, and were first made known[1] through the study of frozen sections by Hart and Carter; these sections were of two specimens—the one a four and a half months' extra-uterine pregnancy, *in situ* in the bony pelvis; the other an entire cadaver with advanced abdominal gestation. From the report of this examination the following passages are taken:

"The consideration of these two sections shows, therefore, a special phase in the development of extra-uterine gestation. They demonstrate that a Fallopian tube pregnancy may develop between the layers of the broad ligament, and may continue this extra-peritoneal growth, stripping off the peritoneum from the uterus, bladder, and pelvic floor until it becomes in great degree surrounded by a peritoneal capsule derived from these organs. All this is done without any actual intra-peritoneal invasion. The placenta in the advanced gestation case is attached in front to the extra-peritoneal connective tissue, the veins there enlarging and acting like uterine veins.

"In this special cadaver, therefore, the gestation began probably in the right Fallopian tube, developed into the layers of the broad ligament, and grew extra-peritoneally, lifting up the peritoneum on the right side of the middle line both anteriorly and posteriorly, and also stripping the posterior uterine wall and upper part of the anterior wall.

"We have here what may be termed a slow displacement of the placenta. At first it lay in the Fallopian tube, but the growing ovum has slowly pushed it up (a process attended with blood extravasation) from the pelvis to the abdominal cavity, until at last its upper edge is about ten inches from its original site. Part of this is due to growth, of course."

The authors suggest that this variety of pregnancy should be termed subperitoneo-abdominal.

Diagnosis. It is by careful study of physiological and pathological symptoms that the diagnosis of ectopic gestation is made. In the first place, the fact of probable pregnancy is to be established; it is not necessary to detail local changes in the sexual organs and the reflex phenomena indicative of this condition. Next, we endeavor to learn that the uterus is not the seat of this pregnancy. This organ, though as a rule increased in size, is not so large as it would be at the supposed period of gestation. Hecker has stated that the uterine cavity may be increased to fifteen centimetres, or more than five inches. There is found adjacent to it a growing, usually pear-shaped, somewhat sensitive tumor, not solid, and with little mobility. Menstruation having been suppressed at one period, possibly two, there occurs a profuse and pain-

[1] Transactions of the Edinburgh Obstetrical Society, vol. xii.

ful flow with the discharge of fragments of decidua, microscopic examination of which will be necessary to determine their character. Gusserow, in a case reported by Glahn, in order to assist in the diagnosis, used a curette for the removal of decidua from the uterus. Should the pregnancy continue until the sounds of the fœtal heart can be heard, and ballottement is available—such prolongation of ectopic pregnancy, it must be remembered, is exceptional—the question is more readily answered. So, too, if the practitioner has sufficient evidence to justify dilating the cervical canal, and the use of finger and sound to explore the cavity of the uterus, the absence of intra-uterine pregnancy can be conclusively proved, and therefore the ovum, provided the woman is pregnant, must be ectopic.

The diagnosis of ectopic gestation in the first months has been a subject of no little controversy. Spiegelberg has said that a diagnosis is all but impossible during the first three or four months, and can only be arrived at in exceptional cases; and Bandl suggests that the practitioner will do well not to make an absolute diagnosis of extra-uterine pregnancy until he can appreciate the certain signs of fœtal life, active movements and the heart-sounds. On the other hand, it has been claimed that the early diagnosis of an ectopic is easier than of a normal pregnancy. The question is very fully discussed by Strahan, whose valuable monograph[1] can be consulted by the practitioner with benefit. Winckel gives the following as probable symptoms which "in their entirety permit a certain diagnosis, especially if their progressive increase is established by repeated observations:"

1. The cessation of previously normal menses.
2. Hyperæmia and secretion of the breasts.
3. Hyperæmia and livid coloring of the vulva and vagina, which increases toward the portio vaginalis.
4. The strongly pulsating arteries in the vault of the vagina.
5. The softening, enlargement and displacement of the uterus.
6. The clearly defined and growing tumor.
7. The vascular murmur or souffle above the symphysis, which is heard at rather an early period.

Dr. Reeve in an article[2] upon the subject, in which it is asserted that a diagnosis "can be made at an earlier period than in a normal pregnancy," refers to cases of its having been made as early as the eighth and fifth week, and gives the following classification and enumeration of symptoms:

"I. *Suggestive.—a.* The general and reflex symptoms of pregnancy, especially if the pregnancy had occurred after a considerable period of barrenness.

"*b.* Disordered menstruation, especially metrorrhagia coincident with symptoms of pregnancy; gushes of blood accompanied with severe pelvic pains.

"*c.* Severe pain in the pelvis; attacks of pelvic pain followed by tenderness in either iliac region, and other symptoms of pelvic inflammation.

"II. *Presumptive.—a.* The existence of a tumor: this tumor presenting the characteristics of a tense cyst, sensitive to touch, actively pulsating; steady and regular growth of the tumor to be observed.

"*b.* The os uteri patulous, the uterus displaced and empty.

"III. *Certain.—a.* Paroxysms of violent and overwhelming pain in the pelvis, with general symptoms of collapse.

"*b.* Expulsion of the decidua."

The employment of the uterine sound is permitted only when there is a probable evidence of ectopic gestation. Kaltenbach warns, if the sound is used, against the danger of perforating the uterus because of its tissues being less firm.

The abdominal tenderness may be so great, especially in an advanced ectopic gestation, that no satisfactory conclusion can be reached without the patient is anæsthetized.

[1] The Diagnosis and Treatment of Extra-uterine Pregnancy, 1889.
[2] American Journal of the Medical Sciences, July, 1889.

Diagnosis of Rupture. The diagnosis of rupture of a tubal pregnancy is made by learning of severe pain in the lower part of the abdomen or pelvis, suddenly occurring, possibly when the patient was making some exertion, straining, stooping, lifting a weight, etc., and this is followed by faintness or fainting and collapse; the skin is cold, the pulse feeble and frequent, and there is acute anæmia. "The diagnosis of tubal pregnancy at the time of rupture may be made with certainty seven times out of eight, and may be guessed at in the eighth instance. The symptoms are too serious to be lightly regarded at any time, and are practically coincident with those of pelvic hæmatocele. If the rupture takes place into the broad ligament, they are the symptoms of extra-peritoneal hæmatocele. If the rupture takes place into the peritoneal cavity, they are the characteristic and most serious group which belongs to intra-peritoneal hæmatocele." (Tait.)

Prognosis. Martin[1] states that the prognosis of ectopic gestation has materially improved under the influence of a better diagnosis and treatment. He gives the following statistics: 255, expectant treatment, 36.9 recoveries, 63.1 deaths; 515, operative treatment, 76.7 recoveries, 23.3 deaths.

Treatment. Admitting the diagnosis of an ectopic pregnancy, almost certainly tubal, before rupture, what course should be pursued? Fœticide, or by abdominal section removal of the gestation cyst? The fœticidal means which have been used are evacuation of the amnial liquor, morphine injection, and electricity. The first is uncertain and dangerous, and is now without an advocate. Joulin in 1863[2] proposed injecting strychnine or atropine into the fœtal cyst, and Friedrich in 1864[3] injected a solution of morphine in a tubal pregnancy. Since then the method has been employed by Koeberlé, Rennert,[4] Tarnier[5] and Winckel. Winckel always injects 0.03 gramme, under the usual precautions, through the abdominal wall, at intervals of six to eight days; two or three injections generally suffice. He claims that this method of killing the fœtus may be practised successfully up to the end of the fourth and even during the fifth month; and also that it is very easy of performance and perfectly innocuous to the mother.

Winckel states that there are now, 1893, sixteen cases of ectopic gestation, ten of them his own, treated by injection of morphine into the gestation cysts, three of the patients dying, or 19 per cent. He regards the treatment as easy, and without danger to the mother; he states that the swelling perceptibly lessens in a short time, and as a rule completely disappears in from six to twelve months.

The Use of Electricity. According to Depaul, Dubois first advised electricity to kill the fœtus in normal pregnancy when grave accidents threatened the life of the mother. Bachetti, of Pisa, in 1857, successfully employed electricity in a tubal pregnancy of the third month; two long needles connected with an electro-magnetic machine were introduced into the cyst. In 1865 Braxton Hicks attempted to destroy the fœtus in an extra-uterine gestation of three months and a half by

[1] Proceedings of Brussels Congress.
[2] Traité complet d'Accouchements.
[3] Virchow's Archiv, 1864.
[4] Arch. f. Gynäkol., 1884–5.
[5] Both in the original and in Dr. Edgar's translation of "Winckel," this name is given as Fournier—evidently a typographical error.

two applications of the galvanic current at an interval of ten days, but failed. In 1869, J. G. Allen, of Philadelphia, succeeded by faradization in arresting pregnancy.

This treatment of ectopic gestation has been so frequently used by American practitioners, so little by others, that it is often called the American method. The galvanic current has been selected in some cases, and abroad—not in this country, I believe, a single time—galvano-puncture, but general preference is given to the faradic current. An ordinary battery, with single cell, is employed; the negative pole is introduced in the vagina or in the rectum as near the tumor as it can be, while the positive pole, connected with a dampened sponge, is placed upon the abdomen. A current, not so strong as to cause the patient any great distress, is passed through the tumor for ten minutes; this is repeated each day until the tumor ceases to grow; four or five applications probably will be necessary. Blackwood, of Philadelphia, who has had a large experience with this mode of destroying the life of the embryo or fœtus, prefers a strong current continued for an hour, but he is probably alone in this preference. The galvanic current has been advised by Rockwell, and has been successfully used in New York in several cases, though the method has differed, in some the interrupted and in others the continuous being employed. Rockwell[1] prefers the former, the strength being from 10 to 20 milliampères.

No impartial reader of the reports of cases by competent and reputable men can doubt that some ectopic gestations have by this means been conducted to a favorable termination; that is to say, the pregnancy was arrested, and the patient suffered no subsequent or serious inconvenience.

Malcolm McLean asserts[2] that "in a vast majority of cases the results of electrical treatment are good, and do not leave the woman in a worse condition."

Brothers, of New York, an ardent advocate of the electric treatment of ectopic gestation, has recently said[3] that "beyond one death in seventy-eight cases no injury has ever been done by the use of electricity, and when it has been abandoned for laparotomy no harm was done by the previous treatment."

Those who substitute death of the ovum for death of the fœtus seem to assume a point in dispute, denying the possible growth of the placenta after fœticidal means have been successfully used. That in some cases the placenta continues to grow does not rest alone upon Mr. Tait's assertion. The same statement is made by Hart and Barbour, Manual of Gynecology. Champneys and Thornton concede the fact, London Obstetrical Society's *Transactions*, vol. xxix. Bandl, in his well-known monograph on extra-uterine pregnancy, refers to the placenta developing for some time after the fœtus is dead. Doléris, *Nouv. Arch. d'Obstét. et de Gyn.*, 1888, says that when the fœtus dies in ectopic gestation "the placenta in these cases often continues to vegetate, for habitually it does not atrophy until the term of gestation has been passed or attained."

[1] American System of Gynecology. [2] American Journal of Obstetrics, 1892.
[3] Ibid., 1894. The writer also asserts that in five cases electricity caused the transfer of the ovum into the uterine cavity. In regard to some of these cases skepticism is wiser than faith.

Doubtless too much has been claimed for electricity, and even some of its earnest advocates abate their zeal and positiveness of utterance. One of them, well known for his honesty and ability, in 1887 stated that 'it was safe to predict that electricity will yet become the only method of treatment in ectopic gestation prior to the rupture of the cyst, and that through this means the dreadful mortality from gestation of this nature will be reduced by fully three-quarters." He also stated that the method is applicable to every form of ectopic gestation prior to the middle or end of the fourth month, and prior to rupture of the cyst. In 1889 the same gentleman said: "Electricity, then, under the third month, with absence of symptoms of rupture, I would advocate. At most it can do no harm, and it may do good."

Treatment by Abdominal Section. Tait remarks that "If I ever should make a diagnosis of tubal pregnancy before rupture, I should advise its immediate removal by abdominal section." Strahan asserts that "the proper treatment of extra-uterine gestation in the pre-ruptured stage, whenever diagnosed, or suspected with great probability rather, is instant abdominal incision and removal of the entire trouble." Werth[1] believes that an ectopic pregnancy ought to be regarded as a malignant tumor demanding prompt removal; in an interstitial pregnancy a pedicle should be made of the lower part of the uterus, and hysterectomy done.

When one realizes by witnessing how suddenly in the midst of apparent health a gestation cyst may rupture, and how swiftly death follows in almost all cases not rescued by a surgical operation; and then upon opening the abdomen he finds sometimes from a rent comparatively small copious bleeding has occurred, he will hesitate to advise in an ectopic gestation, the diagnosis of which is clear, any delay in its removal, even though the pregnancy may not have lasted a month.

Treatment of Rupture. Absolute rest in a horizontal position, sulphuric ether hypodermatically, alcoholic stimulants and the ice-bag, or a sack of sand to the lower part of the abdomen, constitute the most important part of the treatment, which seeks to arrest the flow of blood and to bring about reaction. As soon as the patient reacts, the general rule is to perform laparotomy; some, indeed, would operate immediately.

But take the case of a patient who has passed some days since the accident, all symptoms being favorable, the retro-uterine hæmatocele gradually lessening, the temperature normal, and only slight discomfort or none at all felt. I believe with Winckel, Ahlfeld, and some others that operative treatment under such circumstances is not indicated. If, however, suppuration occur, then this treatment must be promptly employed.

It should be remembered that laparotomy, now so generally resorted to in rupture of an ectopic pregnancy cyst,[2] was advised many years ago by the late Dr. Stephen Rogers, of New York.

When gestation has been half-completed, the child living, most advise immediate operation, having regard only for the mother's life.

[1] Beiträge zur Anatomie und zur operativen Behandlung der Extrauterin-Schwangerschaft, Stuttgart, 1887.

[2] Transactions of American Medical Association, vol. xviii.

This position has recently been controverted. Thus G. Rein,[1] of Kieff, who believes primary abdominal pregnancy sometimes occurs, asserts that the conservative principle should be applied in some cases of ectopic gestation, and that we have not then the moral right to destroy the infant. If the pregnancy has passed one-half, and the proof that the child is living is certain, the conservative method is absolutely indicated, and we ought not to regard the ovum as a dangerous, still less a malignant disease. Placing our patient in the most favorable circumstances for immediate laparotomy, if this should be necessary, we wait until the infant has the best chance of living outside the maternal organism—that is to say, the ninth month of pregnancy.

If the normal period of pregnancy has been reached, abdominal section is done for saving the child's life, and there is also a reasonable probability of saving the life of the mother with certain improvements in the method of operating and subsequent treatment—certainly her chances of recovery are probably not lessened but rather improved by a properly performed operation. The treatment of the placenta has presented the most serious difficulty. Of course, if it can be removed with the fœtal cyst it is a fortunate thing for patient and operator; it is rare, however, that perfect hæmostasis can be secured, as in Eastman's case, or as in the cases of Martin and of Breisky.

Tait in two cases was able to remove the placenta, tying a large pedicle, the remains of the tube and broad ligament, which contained the chief blood-supply to the organ, and in each case the mother as well as the child was saved. But such cases are probably exceptional. There may be no fœtal cyst, and then after the removal of the fœtus the cord is tied and divided, and its placental end is left hanging out of the abdominal wound, a draining-tube being placed by its side. Tedious suppuration follows this method, and the woman may perish of septic infection more than a month after the operation, as in Champney's case, the disease occurring when convalescence seemed established. Tait proposes cutting off the cord near the placenta, closing the sac, and thus leaving the placenta to be absorbed.

Should the fœtus be dead, perishing in the latter half of pregnancy or after false labor, which occurs in cases of ectopic gestation at the normal period of pregnancy, the chances of its conversion into a harmless lithopædion are slight, and the probabilities of painful and prolonged suppuration with the passage of fœtal débris through the rectum, the vagina, the bladder, or the abdominal wall, imperilling the mother's life—in many instances she perishes—are so great that active interference is indicated. Therefore by abdominal section, rarely by elytrotomy, removal of the fœtus is advisable. Unless the indications are urgent, the operation is delayed until the placenta has probably undergone such changes that its removal may be accomplished without serious hemorrhage.

Elytrotomy in ectopic gestation Winckel restricts to cases in which suppuration has occurred and perforation of the vagina is threatened. Nevertheless he quotes two cases in which the posterior vaginal vault

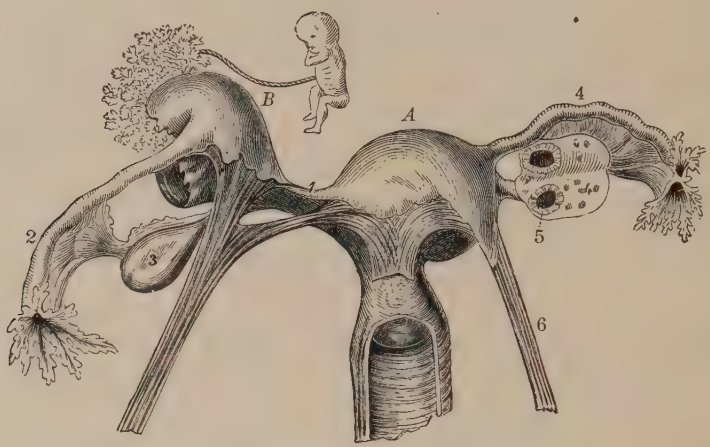
[1] Proceedings of the Brussels Congress.

was opened, and in each case a child extracted by forceps; one of the children lived.

Kaltenbach advised in case of suppuration in the cyst of an intra-ligamentous pregnancy, treating it as an open wound, and filling it with cotton covered with tannin and salicylic acid.

A similar treatment was employed by him in those cases in which the fœtal cyst and placenta could not be removed. The placenta under this treatment shrinks into a dry leather-like mass, and in eight or ten days can be removed without bleeding.

FIG. 164.



GESTATION IN A RUDIMENTARY HORN OF THE UTERUS.

A. Developed right horn. *B*. Rudimentary horn, with a rent through which the embryo had escaped. 1. Right Fallopian tube. 2. Left Fallopian tube. 3. Left ovary. 4, 5. Right ovary and corpus luteum. 6. Round ligament.

PREGNANCY[1] IN A RUDIMENTARY HORN OF THE UTERUS. The symptoms of cornual pregnancy are those of tubal, and the treatment in no respect differs.

ECTOPIC DEVELOPMENT OF THE PLACENTA—VICIOUS INSERTION OF THE PLACENTA—PLACENTA PRÆVIA.—Benjamin Pugh, in his treatise upon Midwifery, 1754, remarked that "the placenta sometimes loosens before the membranes, which contain the waters, are broke, and by the child's turning itself, it is sometimes found to present at the mouth of the womb," etc. This was the explanation generally given by obstetricians of those cases in which the placenta was found at the mouth of the womb previous to the birth of the child. Nevertheless, Paul Portal, in 1685, had spoken of firm adherences between the placenta and parts contiguous to the mouth of the womb; and Schlacher, in 1709, had given an anatomical demonstration of this condition upon the body of a woman dead from uterine hemorrhage. Rigby, whose admirable *Essay*[2] was published in the latter half of the eighteenth

[1] An interesting report of a case successfully operated upon by the late Dr. Angus MacDonald will be found in the tenth volume of the Edinburgh Obstetrical Society's Transactions. Dr. MacDonald with the report has also given a good *résumé* of the cases observed up to that time.

[2] An Essay on the Uterine Hemorrhage which precedes the Delivery of the Full-grown Fœtus, illustrated with cases. The fourth edition was issued in 1789.

century, made a distinction which is still recognized, between accidental and unavoidable uterine hemorrhage, the former occurring when the placenta occupies its normal position, the latter when "it is fixed to that part of the womb which always dilates as labor advances." It will be observed by the words just quoted from Rigby that those authors who have attributed unavoidable hemorrhage, occurring in pregnancy, to the abnormal situation of the placenta, have no authority from him for such use of the word unavoidable. Rigby's definition of placenta prævia is that which is in accordance with the most recent knowledge. For example, Spiegelberg has said that the placenta is prævia when a greater

FIG. 165.

COMPLETE PLACENTA PRÆVIA; OS PARTLY OPEN. (From RAMSBOTHAM.)

or less part of it is situated in that part of the lower segment of the uterine body which must be stretched in labor. He further compares this portion of the uterus to a hemisphere which during parturition must be converted into a cylindrical canal. The lower segment of the uterus is bounded below by the internal os, and its upper limit is two or two and one-half inches, measured along the uterine wall, above. This must be changed into a cylindrical canal having a diameter of eleven centimetres, or four and one-half inches.

Varieties. It has been customary to describe these as central, partial, marginal, and lateral. But I think it better to have only two varieties, complete and partial. A central implantation of the placenta —that is, the centre of the placenta corresponding with the centre of the os uteri—is exceedingly rare, and therefore should not be made a variety, but is included under the term complete; while partial placenta prævia embraces all cases in which the placenta is in whole or in part attached to some portion of the lower uterine segment, whether it extends partially over the os, is at its margin, near to it, or somewhat remote.

Fig. 166.

Partial Placenta Prævia. (From Ramsbotham.)
The os partly dilated; the membranes entire.

Frequency. 1 in 573, Johnson and Sinclair; 1 in 575, Guy's Hospital Lying-in Charity, Galabin; 1 in 1000, Spiegelberg. In adding up the statistics given by Depaul, from Ramsbotham, Schwartz, Arneth, Klein, Collins, MacClintock, and Hardy, and from the Maternity at Wurzburg, and the *Hôpital des Cliniques de la Faculté de Paris*, amounting in all to nearly 600,000, I find the proportion of cases of placenta prævia 1 to a little more than 1200. Winckel makes the proportion 1 in 1500; Kaltenbach 1 in 1500–1600.

Etiology. Placenta prævia occurs more frequently in multigravidæ than in primigravidæ, in the poor than in the rich, either, as suggested by Spiegelberg, because of hard work in the early part of pregnancy, or more probably from subinvolution of the uterus. Anomalies of the uterus or neoplasms predispose to it; hence it is more frequent in uterus unicornis and bicornis, and in carcinoma and myoma. Ingleby has re-

corded two cases in which the oviducts entered the uterus near the internal os; one of the women had placenta prævia three, and the other ten times.

It is probable that the most important of causes, and to which some of those that have been mentioned conduce, is endometritis with catarrh.

FIG. 167.

PARTIAL PLACENTA PRÆVIA. (From RAMSBOTHAM.)

The same case after rupture of the membranes; the head pressing on the placenta, prevents further loss of blood.

Reamy has suggested that the prævial implantation of the placenta may originate in sexual intercourse occurring fifteen or sixteen days after menstruation, the delay being with the hope of preventing conception, and Pinard asks if travelling early in pregnancy, with consequent jolting in carriages or cars, may not be a cause. Osiander taught that lying upon the back tended to cause attachment of the placenta at the fundus, while standing or sitting after coition favored implantation over the os. Müller, in his monograph upon *Placenta Prævia*, states that some accuse conception during menstruation, and others coition when the uterus has a more vertical position, and hence when the parties are standing, as causes.

Winckel states that plural pregnancy predisposes to the anomaly, it being then, according to his experience, four times more frequent. In 1890 Hofmeier[1] concluded, from the examination of the uterus of a woman pregnant with twins, and dying in the fifth month, that in most if not all cases placenta prævia originated from the development of the placenta within the reflexa of the lower pole of the ovum. In

[1] Zur Anatomie und Aetiologie der Placenta Prævia.

the illustration it will be observed that part of the reflexa upon which the placenta has formed is not yet united with the vera.

Kaltenbach has made the following statement: Through preparations made from the early period of pregnancy Hofmeier and I have shown that in placenta prævia the placental development takes place within the reflexa of the under pole of the ovum. The under surface of the prævial placenta is covered with smooth reflexa that later will unite with the vera lying opposite.

Fig. 168.

Illustrating Hofmeier's Theory of Placenta Prævia.

The views of Hofmeier and Kaltenbach have been accepted by several eminent German obstetricians, such as Olshausen and Martin, but rejected by others, as Winckel and Ahlfeld.

Hart holds[1] that there is primary implantation of the ovum low down, or even over the os internum. The hypothesis upon which he proposes to explain this low implantation "is that the human ovum can graft only on a surface denuded of epithelium, and that it does not graft thus, but in some part of the uterine cavity where the epithelium has been removed by menstruation. If, then, the ovum does not meet with the connective-tissue surface until it has passed low down in the uterine cavity, some form of placenta prævia will happen."

Barnes states[2] that the "ovum sought attachment to healthy endometrium; if the upper part was diseased, the ovum would be apt to stretch lower, that is, within the lower zone."

Barnes teaches that the site of safe and most natural attachment of the placenta is in the fundal zone, as shown in the diagram. Equatorial attachment is next in safety. The lower polar circle is the boundary line below which, according to Barnes, we have spontaneous placental detachment and unavoidable hemorrhage, and above which spontaneous placental detachment and hemorrhage do not occur.

Complications. The placenta is thinner than usual and extends over a larger surface, and there are frequently abnormal adhesions between it and the uterine wall, this condition being found in nearly one-third. A placenta succenturiata is not uncommon, and sometimes the placenta is bilobed; the bridge which connects the two parts may be directly over the os. Generally the attachment of the cord is marginal; in some cases velamentous.

Unfavorable presentations are found in a large proportion of cases. Thus in 1148 cases of prævial placenta, according to Charpentier's statistics, there were 66 per cent. in which the head presented, 24 per cent. of presentations of the shoulder, and 9 per cent. of the breech. Auvard states that other presentations than of the head are found in

[1] Transactions of the Brussels Congress.
[2] Proceedings British Medical Association, 1889.

from 20 to nearly 50 per cent. of all cases. Of course, this anomaly is in part to be attributed to the fact that in a large proportion of cases labor is premature.

Fig. 169.

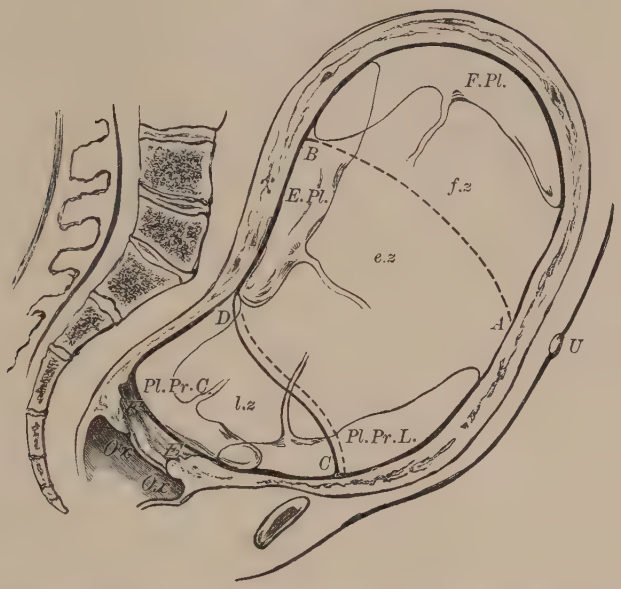


Diagram Illustrating Barnes's Theory of Placenta Prævia.

Division of uterus into zones: *A.B.* Upper polar circle. *C.D.* Barnes's lower polar circle, or Bandl's ring. *E.F.* Circle of os internum. *Ox.* Os externum. *f.z.* Fundal zone. *e.z.* Equatorial zone. *l.z.* Lower zone. *F.Pl.* Fundal placenta. *E.Pl.* Equatorial placenta. *Pl.Pr.L.* Lateral placenta prævia. *Pl.Pr.C.* Central placenta prævia.

Hemorrhage. This is the dominant symptom of ectopic placenta. The bleeding is usually sudden and frequently without obvious exciting cause. It occurs at irregular intervals, and may disappear almost as suddenly as it occurs. Whenever a woman has such hemorrhage in the last two or three months of pregnancy and is not suffering from albuminuria, the probability is the placenta is previous.

The time of the hemorrhage is usually, according to Kaltenbach and Ahlfeld and other authorities, from seven to eight months, but, as stated by Ahlfeld, it in a few cases is delayed until the ninth month, and more rarely does not begin until labor. Depaul held that almost all the hemorrhages caused by prævial placenta occurred in the last six weeks of pregnancy. Winckel states that in partial placenta prævia the bleeding generally occurs only after the thirty-second week, and in complete between the twenty-eighth and thirty-sixth week.

The Source of the Hemorrhage. When the placenta is partially detached there are two surfaces with torn vessels, one placental, the other uterine; from which does the bleeding come? Somewhat and briefly from the placental, but its chief source is the uterine surface. The proofs which authorize this statement are, first, the hemorrhage may continue after labor is over; second, and it also may be present

during labor when the fœtus is dead; third, if a pregnant animal be opened so that the interior of the uterus is exposed, and the placenta be partially detached, the blood is seen to come from the uterine surface. The theory of the placental origin of the bleeding was held by the late Sir James Simpson. He said, in 1845: "I believe with Dr. Hamilton and others that the discharge issues principally or entirely from the vascular openings which exist on that exposed placental surface." Acting upon this theory, he was led to uphold the practice of detaching the placenta in case it presented at the mouth of the womb, and became involved in a controversy with Robert Lee[1] in regard to both his theory and practice; and in one with Radford, who claimed priority in this method for Kinder Wood and himself. Winckel states the causes of hemorrhage are rupture of the utero-placental vessels, laceration of a placental sinus, and detachment of the placenta by shocks or trauma, or by contractions.

The Causes of the Detachment of the Placenta. Those who hold that hemorrhage prior to labor is accidental, at the same time state that the accident is much more liable to occur in ectopic development of the placenta than when this organ occupies its normal position, and that, as taught by Rigby, unavoidable hemorrhage occurs only in childbirth. Others explain the detachment of the placenta by failure of correspondence between its development and that of the uterus. But while Jacquemier[2] attributed to the uterus such rapid development that the placenta could not follow it, Legroux upheld the opposite—that is, the placenta is extended too rapidly with reference to the lower uterine segment. According to one hypothesis, the uterus grows away from the placenta, and according to the other the placenta grows away from the uterus. Barnes has maintained the latter view, stating[3] "that the first detachment of the placenta arose from an excess of growth of the placenta over that of the lower region of the uterus to which it was attached; that the structure of the uterine region was ill-fitted to keep pace with the placenta; hence loss of relation, the placenta shoots beyond its site, and hemorrhage results." But Bitot[4] answers this theory by the statement that at the time in pregnancy when the hemorrhages usually occur the development of the placenta has been completely accomplished (Depaul). Admitting it true, as claimed, especially by French authorities, that the development of the fundus is completed in the first seven or eight months, if the placenta were attached to it or in its vicinity, the rapid growth of the placenta at the time alleged by Barnes would be in all cases a necessary cause of hemorrhage.

Depaul[5] has said that "it may be stated that the hemorrhage consequent upon vicious insertion of the placenta results from this, that all the parts of the uterus are not developed in the same degree, and while the fundus and adjoining portions

[1] This controversy was exceedingly bitter, especially on Dr. Lee's part. In one of his last—it not the last—contributions upon the subject, he denounced Professor Simpson's view as to the source of the hemorrhage as "a gross, unparalleled, and unretracted blunder."—Lancet, vol. ii., 1847.

[2] Placenta Prævia, by Auvard.

[3] Obstetric Medicine and Surgery.

[4] Contribution à l'Etude du Mecanisme et du Traitement de l'Hémorrhagie liée a l'Insertion Vicieuse du Placenta.

[5] Leçons de Clinique Obstétricale.

take at the beginning of pregnancy a considerable amplitude, and this during the first six months; the lower segment of the uterus, on the contrary, is not notably developed until in the last three months. Moreover, the development of all these regions is not made in a uniform manner. I have had the opportunity of examining the uterus of women who have died in the last months of pregnancy, and I could see in the inferior portions that the increase was not everywhere the same. The anterior region is generally developed much more than the posterior, and as I have said in a report which I presented to the Academy, if a vertical line be passed downward from the fundus of the uterus, its lower end, far from passing through the cervix, or near it, would traverse the anterior wall of the uterus at a variable distance from the cervix, which lies posteriorly." He further stated that the lateral parts are developed unequally, the one increasing more than the other, this disproportion being evident when a horizontal line is placed connecting the uterine orifices of the tubes; the line will be found one or two centimetres below the tube of the opposite side; further, it is impossible to point out precisely either what part of the fundus is developed most, or when this increase is arrested. "On the other hand, the lower segment is certainly developed much later, but it is impossible to assign a fixed epoch for the beginning of this phenomenon, variable in each woman, and we can only say that in general it commences from the sixth to the seventh month." Spiegelberg, however, entirely rejected this view in explaining the hemorrhage. He maintained that the bleeding arises from uterine contractions, causing partial detachment of the placenta; when premature labor[1] occurs, as it very frequently does in placenta prævia, it is not caused by the hemorrhage, but it causes the hemorrhage.

No matter, however, the hypothesis accepted, it is obvious that the hemorrhage is unavoidable.

Diagnosis. Leopold[2] asserts that the course of the tubes is a certain criterion for the situation of the placenta. When the tubes pass upon the anterior wall of the uterus, converging in their progress, the placenta is situated posteriorly; but if they pass upon the lateral borders of the uterus, thus nearly parallel with its long axis, the placenta is anterior.

Of course, not finding either distinctive disposition of the tubes, at least the suggestion of prævial placenta would occur.

Spencer[3] claims that the diagnosis of placenta prævia may be made by abdominal palpation. The following is his method:

"The patient lies upon her back in the usual way. As a rule, little advantage is obtained by drawing up the knees in examining by the abdomen a uterus in the later months of pregnancy. It is very important that the bladder should be emptied. The examination is to be made between the pains.

"In an ordinary vertex presentation (the placenta being in the upper segment of the uterus) the head lies almost transversely at the beginning of labor, and the occiput and the forehead (at a higher level) are to be easily and distinctly felt by the fingers of the two hands laid out flat outside of the recti with the points downward. Sometimes the nose is felt, and I have felt an ear; but the occiput, the forehead, and the side of the head are to be clearly made out in the majority of cases under favorable circumstances.

"If, however, placenta prævia be present, and the placenta be in front or at the side, an unusual swelling may be noted, and the head is no longer felt where the placenta is situated; in lateral placenta prævia the head may be more distinctly felt on the oposite side than in a normal labor. Where the placenta is placed it feels as if the fingers were kept off the head by a mass of elastic consistence like that of a wetted bath-sponge; in some cases a distinct edge is felt. The edge is shaped like the segment of a circle. Within the circle all is obscure to the touch.

[1] According to King's statistics (Transactions of the State Medical Society of Indiana), premature labor occurs in about one-half the cases. Lomer's statistics correspond in this respect.
[2] Geburtshülfe und Gynäkologie, ii. Band, 1895.
[3] Transactions of the London Obstetrical Society, vol. xxxi.

Outside the circle the head or other parts of the child are distinctly felt. Impulses to the head are not distinctly perceived through the placenta, whereas impulses to the head through the placenta are plainly felt at the spot from which the placenta is absent; this applies also to the combined vaginal and abdominal examination. In doubtful cases it is important that several examinations should be made, and it is constantly to be borne in mind that the placenta always keeps the same position. The examination should be conducted gently, and often a considerable time—several minutes—may be necessary to satisfy one's self of the presence of the placenta. But if the head is anywhere plainly and distinctly felt, it may be safely decided that the placenta is not at that spot. If a doubtful spot remains, a subsequent examination may clear up the difficulty."

The time in pregnancy when hemorrhage occurs, its apparently causeless appearance, abrupt cessation, and frequent recurrence; the greater throbbing of arterial vessels upon vaginal examination with the finger, the softened and relaxed condition of the lower portion of the uterus, and the inability to feel distinctly the presenting part of the fœtus would render probable that the placenta was previous; so, too, probability would be given by seeing a deeper purplish hue of the vagina, especially at its upper part, and the adjacent portion of the uterus. Complete certainty is had by passing the finger into the cervical canal, and recognizing placental tissue; this tissue must not be confounded with blood-clots and thickened decidua.

Prognosis. Ahlfeld states that probably in general practice 25 per cent. of women die, part in consequence of the bleeding, and part from infection; Kaltenbach believes that nearly as many die from the latter as from the former. Winckel asserts that the maternal mortality need not be greater than 5 or 10 per cent., while the fœtal mortality is seldom less than 50 per cent., and in some statistics is from 70 to 75 per cent.

Of course, the mortality will depend chiefly upon the variety of placenta prævia, being greater in complete than in partial; in some of the latter cases, the lower margin of the placenta, though still in the inferior uterine segment, being not near the os, the hemorrhage may at no time be serious. So too, the earlier the abnormal condition is recognized, and the prompter and the more efficient the means, the more favorable the result. As a rule, premature labor is better, so far as the chances of the mother and the child surviving.

Treatment. If loss of blood be slight, and especially if the fœtus be not yet viable, the expectant plan is indicated.[1] The patient should lie down, be lightly covered, use cold drinks, and if much pain or restlessness be present, opium may be given. She ought to be directed not to take active exercise, to avoid as much as possible the erect position, and all straining at stool. It would be well if there was some one at hand who was properly instructed in the application of the vaginal tampon, so that this may be at once used should grave hemorrhage occur.

[1] This advice has been condemned by some critics, for the obstetric knowledge and ability of one of whom I entertain the greatest respect. I shall not quote, as I might, from Churchill, Depaul, and Spiegelberg in vindication, but simply introduce the words of Winckel as one of the most recent and highest authorities, who in referring to hemorrhage in pregnancy says: "Should the hemorrhage be moderate, it is sufficient for the patient to rest in bed." The objection to arresting at once the pregnancy before the child is viable is obvious; such treatment utterly disregards its life, and I still believe should not be employed unless the interest of the mother imperatively demands it.

But if the fœtus is viable, and the hemorrhage is severe, the doctrine enunciated by Baudelocque nearly three-quarters of a century ago ought to direct the treatment.[1] "The necessity of effecting delivery without having regard to the time of pregnancy, when the loss of blood is so abundant as to imperil the life of the mother and that of the child, has been recognized for more than two centuries." Admitting this principle, the question arises as to how the delivery is to be effected. The simplest, shortest, and safest way is to induce premature labor, or, as nature is in many cases endeavoring to do this, assist her efforts. This practice has been especially advocated by Greenhalgh and Thomas, while many others have been following it without calling it the induction of premature labor. By the use of Barnes's dilators the os is effectively plugged, and at the same time its rapid expansion secured, when if the presentation be favorable, and the uterine contractions active, the membranes may be ruptured and the completion of labor left to nature.

Doctor D. Draghiescu,[2] Bucharest, from a consideration of 61 cases of placenta prævia, the maternal mortality being 15.08, and that of the children 59.02 per cent., advises if hemorrhage occurs in pregnancy, the loss of blood not being great, expectation, antiseptics, rest, and tonics. If hemorrhage recurs, the tampon. The treatment in labor is, if the hemorrhage is slight, rest and antiseptic hot-water injections. The tampon is used if the flow is great, and internal version as soon as practicable.

Different Methods of Treating Placenta Prævia. Having stated the general principle which should govern the treatment of placenta prævia, and the way in which this may be accomplished, it is proper that various methods which have been recommended should be mentioned.

The Tampon. French obstetric writers have given to Leroux, 1776, the chief credit for the use of the tampon; nevertheless this author mentions no instance of its application in placenta prævia. The honor of this application of the tampon undoubtedly belongs to Wigand; by means of it he attained a success in the treatment of placenta prævia quite equal, if not superior to, that of any other method. At the time he was led to make use of the tampon, *accouchement forcé* was the general practice, a practice which involved serious dangers and great fatality. After many years' experience with the tampon, and having had a large obstetric practice, Wigand stated that he "had not lost a single child or mother," and that he had secured by the method a normal lying-in.[3]

Different methods of tamponing the vagina have been used. The rubber bags introduced flaccid in the vagina, and afterward distended

[1] Traité des Accouchements.

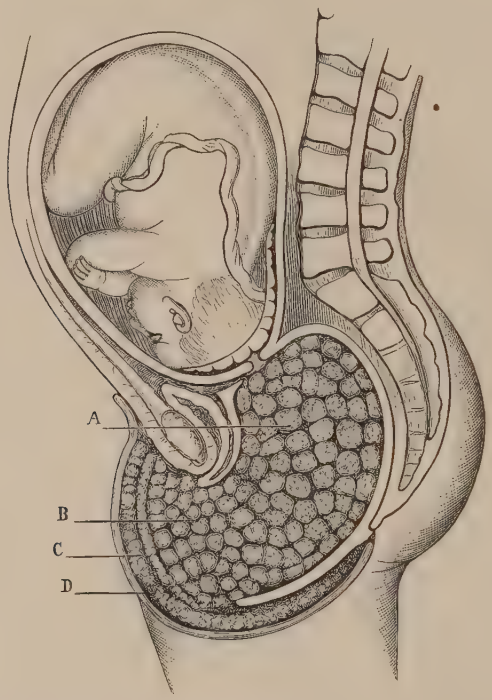
[2] Considérations sur 61 cas de placenta prævia. Bucharest, 1892.

[3] Die Geburt des Menschen, etc. The work was edited by Franz Carl Naegele, and published in 1820, three years after Wigand's death. Notwithstanding the success of his method, which he had been pursuing for so many years, and his frequent publications concerning it, he stated that as far as he knew he had not "a single follower."

Wigand employed the tampon treatment in the latter part of the last century. Nevertheless, a recent writer has stated that it was "about fifty years ago;" but, as Wigand has been dead for nearly eighty years, of course this is a mistake. In the former edition I gave quite fully Wigand's method of treatment, partly as a matter of historical interest, vindicating his priority, and also to show his remarkable success with the tampon. Winckel in referring to my statements remarks: "Parvin is correct in saying that Wigand should be credited with having first applied the tampon in this manner in placenta prævia; and also in the statement that this had already been done toward the close of the last century."

with air, are, in the opinion of most obstetricians, unreliable, for they cannot be perfectly adapted to the vaginal vault, and thus leave a space in which blood may collect. Other objections that have been made to the colpeurynter are that it is liable to tear, and that it may be the medium of infection. A tampon can be made of balls of absorbent cotton, each ball being about the size of a small walnut; fifty or sixty of these will generally be required—a hatful, according to Pajot. The bladder and rectum should be emptied, the vagina thoroughly cleansed by an antiseptic solution, and all clots removed; the patient may lie

FIG. 170.



VAGINAL TAMPON IN PLACENTA PRÆVIA. (After BAILLY.)

A. Deeply placed dossils to each of which a cord is attached. B. Superficial dossils without cord. C. Pledget of charpie or pad of cotton. D. T-bandage.

upon her side or upon her back, the latter position is selected if Sims's speculum be used, but this instrument is not essential for perfect tamponing of the vagina. The obstetrician takes one of the cotton balls after it has been dipped in an antiseptic solution, or covered with an antiseptic ointment—that of iodoform is excellent—and by means of suitable dressing-forceps carries it up to the vaginal vault; one after another is thus introduced until the vault is completely occupied; the os is filled or covered with the cotton balls, and after this the rest of the vagina is perfectly packed, a large piece of cotton placed between the labia, and the whole secured by a napkin and a T-bandage. The

dossils of cotton first introduced may each have a string attached to them to facilitate their removal. The use of astringent solutions into which the balls are dipped is unnecessary, and may be injurious by irritating the vagina; arrest of bleeding by pressure, not by coagulation, is the purpose accomplished by the vaginal tampon. Strips of iodoform or creolin, or other antiseptic gauze, may be used for a tampon.

The tampon has another important effect in the majority of cases: it excites the action of the uterus; thus in 78 out of 128 cases given by Müller,[1] strong uterine contractions followed its application.

Winckel states that he "employs cotton tampons almost exclusively in labors complicated with placenta prævia, and they are applied so firmly that not a drop of blood flows from the vulva—a condition rarely attained by the colpeurynter even when filled to the utmost. In central placenta prævia and in lateral, tamponing should be continued until the os is almost completely dilated, so that either the presenting fœtal part may enter and plug it, or the compression of the placenta be obtained by introducing the hand and bringing down the breech into the os. This method of tamponing the vagina in placenta prævia has recently been violently assailed and denounced as unscientific in principle, dangerous in practice, uncertain in controlling the hemorrhage, and a prolific source of septicæmia." . .

"If the hemorrhage in placenta prævia springs from the wall of the uterus—whether a lower uterine segment has developed or not—we must endeavor in every case to compress the bleeding vessels by as direct a pressure as possible. This purpose is accomplished by the tampon in an indirect, not direct, and at the same time in a thoroughly scientific, manner. The distention of the vagina by the tampons, and the irritation of the ganglia in the upper part of the anterior vaginal wall which they effect, cause an intense desire to bear down and an increased activity of the uterine contractions. We increase on the one hand the expulsive force of the uterus, and on the other hand its power of resistance, and last but not least, we also prepare the os by this dilatation of the vaginal vault, and render it more yielding in case any operation is called for."

Winckel further states that he has never had a patient die from septicæmia consequent upon using the tampon.

Tarnier has the tampon remain twelve hours; Depaul did not remove it for at least twelve or fifteen hours, or twenty-five to thirty hours at most; it is doubtful if any harm will result should a properly applied antiseptic tampon be left for twenty-four hours. After its removal the vagina must be thoroughly cleansed with an antiseptic solution; a new tampon is introduced if hemorrhage continues, and if immediate delivery is not practicable, unless the practitioner, following the method pursued by Pajot and Bailly, and which was that of Wigand, leaves the tampon in place to be expelled by the uterine and abdominal contractions which expel the fœtus; this plan was practised and warmly advocated for many years by the late Dr. Mears, of Indianapolis. Exclusive reliance upon the tampon in the treatment of placenta prævia is the custom of only a few practitioners; the majority of those who use it regarding it as simply a temporary means. Müller,[2] after observing that it is neither a sovereign remedy, as its friends claim, nor to be entirely rejected, as its opponents desire, remarks that it is an important aid which should be used at the right time, and then no longer than is necessary; apply it when the os is rigid and only slightly opened, if violent hemorrhage occurs, for immediate delivery is impossible; time is thus gained without

[1] Placenta Prævia. [2] Op. cit.

danger, for even if it does not stop, it lessens the bleeding and prepares the parts for labor.

It has been objected to the tampon that it may convert an open into a concealed hemorrhage. The answer is, that in no case has such a result followed the use of a properly applied tampon. If during active labor the tampon is forced down by utero-abdominal contraction, and then when the contraction ceases there is recession of the uterus, leaving a space at the upper surface of the tampon in which blood may collect, the accident is prevented by the practitioner at once pressing the tampon back as soon as the bearing-down effort ceases; or the same object may be accomplished by having the bandage which secures it made of elastic material which retracts after having been stretched during the uterine and abdominal contraction. Bailly[1] has stated, in considering the treatment of placenta prævia, that authors are unanimous upon this point. Whenever in pregnancy or in the first part of labor a hemorrhage, dangerous in amount or continuous, occurs, we ought to tampon. Madame Lachapelle's observations prove that sometimes she left the delivery in women she had tamponed to Nature. Pajot and then Weil, taught that after having tamponed women suffering with hemorrhages from placenta prævia the delivery should be left to Nature, this method giving the best results for the mothers. The tampon must be closely applied to the os during a uterine contraction, so that no space will be left for the accumulation of blood. Bailly makes the following conditions necessary for the use of the tampon: First, there must not be uterine inertia. Second, the tampon must be properly made and applied; the pieces of charpie should be covered with cerate, and a speculum should not be used in their introduction. Third, the presentation must be cranial or pelvic.

According to the statistics given by Auvard, when the tampon was used the maternal mortality was 6 per cent., and the fœtal mortality 55 per cent.

Ergot. Auvard states it as the method of Paul Dubois. Statistics show that the results of this treatment are: maternal mortality 42 per cent., and fœtal mortality 77 per cent. If no ergot be given, the former is 24 per cent., and the latter 47 per cent. Auvard adds that these figures are eloquent. Ergot given in these conditions kills almost one-half of the mothers and more than one-third of the children.

Complete Detachment of the Placenta. This has already been referred to as the method of Simpson.[2] While the results as furnished by Simpson's statistics were very favorable in regard to maternal mortality, they showed an enormous fœtal mortality; it should be stated that the statistics of others are less favorable in regard to maternal mortality, and the method has now only a mere historical interest.

Partial Detachment of the Placenta. There are two varieties of this: Barnes's and Cohen's.

The Method of Barnes. This is founded upon the proposition that the "physiological arrest of flooding is neither permanent nor secure until the whole of that portion of the placenta which had adhered within the lower zone of the uterus is detached—that being the portion which is liable to be separated during the opening of the lower segment of the uterus to the extent necessary to give passage to the child."[3] His directions as to detaching the portion of the placenta involved in this dilatation are as follows: "Pass one or two fingers as far as they will go

[1] Gazette des Hôp., 1873.
[2] Charles, Cours d'Accouchements, curtly calls it "brutal for the mother and mortal for the child."
[3] Obstetric Operations.

through the os uteri, the hand being passed into the vagina, if necessary; feeling the placenta, insinuate the finger between it and the uterine wall; sweep the finger round in a circle, so as to separate the placenta as far as the finger can reach; if you feel the edge of the placenta where the membranes begin, tear open the membranes freely, especially if they have not been previously ruptured; ascertain, if you can, what is the presentation of the child before withdrawing your hand. Commonly, some amount of retraction of the cervix takes place after the operation, *and often the hemorrhage ceases.* You have gained time. You have given the patient the precious opportunity of rallying from the shock of a previous loss and of gathering up strength for further proceedings.

"If the cervix being now liberated, under the pressure of a firm binder, ergot, or stimulants, uterine action returns so as to drive down the head, it is pretty certain there will be no more hemorrhage; you may leave nature to expand the cervix and to complete the delivery; the labor, freed from the placental complication, has become natural." Murphy,[1] pursuing the plan of partial detachment of the placenta, as advised by Barnes, and dilatation of the os by Barnes's dilators, in 23 cases saved ten children and all the mothers.

Combined Turning. In 1864 Braxton Hicks's well-known volume upon *Combined External and Internal Version* was published, and in it he advised the method which in recent years has been so successfully used, more especially by German practitioners, in the treatment of placenta prævia. Lomer[2] thus describes it: "Turn by the bimanual method as soon as possible, pull down the leg, tampon with it and with the breech of the child the ruptured vessels of the placenta. Do not extract the child then, let it come itself, or at least only assist its natural expulsion by gentle and rare tractions. Do away with the plug as much as possible; it is a dangerous thing, for it favors infection, and valuable time is lost with its application. Do not wait in order to perform turning till the cervix and the os are 'sufficiently dilated to allow the hand to pass.' Turn as soon as you can pass one or two fingers through the cervix. It is unnecessary to 'force your fingers through the cervix' for this. Introduce the whole hand into the vagina, pass one or two fingers through the cervix, rupture the membranes, and turn by Braxton Hicks's bimanual method. Use chloroform freely in performing these manipulations. If the placenta is in your way, try to rupture the membranes at its margin; but if this is not feasible, do not lose time, perforate the placenta with your finger, get hold of a leg as soon as possible, and pull it down."

The following is a summary of the teaching of Braxton Hicks.[3] We present it, only remarking that the first rule may be questioned. Is every case of pregnancy with placenta prævia to be at once ended, even though serious hemorrhage be absent, and the fœtus not yet viable?

1. After diagnosis of placenta prævia is made, we proceed as early as possible to terminate pregnancy.
2. When once we have commenced to act we are to remain by our patient.
3. If the os be fully expanded and placenta marginal, we rupture the membranes and wait to see if the head is soon pushed by the pains into the os.

[1] Medical Press and Circular, 1885.
[2] Op. cit.
[3] British Medical Journal, Nov. 30, 1889.

4. If there be any slowness or hesitation, then we employ forceps or version.

5. If the os be small and placenta more or less over it, the placenta is to be carefully detached from around the os; if no further bleeding occur, we may elect to wait an hour or two. Should the os not expand, and if dilating bags are at hand, the os may be dilated. If it appear, then, forceps can be admitted easily, they may be used; but if not, version by combined external and internal method should be employed, and the os plugged by the leg or breech of the child; after this is done the case may be left to nature, with gentle assistance, as in footling and breech cases.

6. If the os be small, and if we have neither forceps nor dilating bags, then combined version should be resorted to, leaving the rest to nature, gently assisted.

7. If during any of the above manœuvres sharp bleeding should come, it is best to turn by combined method in order to plug by breech.

8. When the fœtus is dead, or labor occurs before the end of the seventh month, combined external and internal version is the best method, no force following.

In reference to the general subject of podalic version in placenta prævia the following extract from Rigby is of interest:[1] "From what has been said it appears, then, that the placenta is fixed to the os uteri much more frequently than has hitherto been supposed; that when it is so situated, nothing but turning the child will put a stop to the flooding."

It appears that Martin[2] in 1876 made the definite proposal for the treatment of placenta prævia which has later been established by Behm, Hofmeier, Schülein, and others. The chief point in this treatment, as proposed by Martin, was to bring down the hips of the child so that their pressure would stop bleeding from the partially detached placenta, and at the same time the activity of the uterus be excited.

Murphy's Method. This is fully presented in the author's words:[3]

"The practice which I follow consists not in a single method for stopping hemorrhage, but in several, and it is this: In the first place, in every one of my own patients, or in those that I am consulted about, when hemorrhage occurs after the seventh month, when it is clearly not from the cervix or os, and when there is presumptive evidence that it is from the placenta prævia, I advise premature labor to be induced; or before that period of pregnancy when the hemorrhage is severe, continuous, or frequently recurring. In cases that permit of a little delay from the symptoms not being very urgent, I appoint a time when I can give a few hours' continuous attendance—two hours are generally sufficient—as once you commence to induce labor I consider it necessary to remain with the patient until delivery is accomplished; and when the case does not require instant action one can fix his own time and can have what assistance he requires.

"I find having an assistant a great advantage, and by thus arranging a definite time practitioners can secure the services of a specialist or fellow-practitioner to help them and to share the responsibility. On examination, if the cervix will permit it, I introduce my finger, separate the placenta all around, and then put in a Barnes bag; and if not, I gently and slowly insinuate my finger through the os, which I have

[1] Op. cit. [2] Lehrbuch der Geburtshülfe, von Dr. A. Martin, 1891.
[3] Medical Press and Circular, 1885, p. 208.

always found easy of accomplishment, never having had recourse to the preliminary introduction of a tent, though in inducing labor for other causes I have frequently had to introduce tupelo tents. Having thus dilated the cervix with my finger, I separate the placenta freely around the internal os, and at once introduce a Barnes bag. I slowly fill it with water—and here let me give a practical hint on the use of hydrostatic bags, which I do not remember to have seen mentioned in any of the text-books: When the bag is well through the cervix it is very difficult to say how full it is, and by continuing the injection it may very easily be burst, as once happened to myself, and has, I know, happened to many others; so, to avoid this, it is desirable to ascertain and remember how many syringefuls each bag requires before being fully dilated, and then carefully to inject only that number. Having thus filled the bag, I wait patiently until the os is well dilated around it, and, before introducing another one, separate the placenta further should the hemorrhage continue, which it does not, provided the placenta has been sufficiently separated at first. After the bag has been introduced for some time the pains come on fairly well, though, as a rule, they are not very strong.

"I thus proceed until the os is fully dilated, when I give ergot freely, and decide what is the most suitable course to follow. If the placenta is lateral or marginal, and the pains fairly strong, I rupture the membranes and leave the case to nature; or, if the head is well into the pelvis, I may apply the forceps, but in the great majority of cases I perform version, preferably by the combined method, and deliver the child as quickly as is consistent with the safety of the mother."

Murphy (1889) had 58 cases, with only 2 deaths; one of these was from septicæmia, and the second occurred in a woman who was dying when he was called to her. He believes that it should be a rule to induce premature labor in every case of placental presentation if the pregnancy has advanced to seven months, and even before this when the bleedings are frequent and serious. Murphy's results, both as to maternal and fœtal mortality, have been very good—much better in the latter regard than those secured by the Hicks method. This sustains, too, the position taken in the beginning of the consideration of the treatment, viz., the "induction of premature labor in all cases of placenta prævia when the hemorrhage is serious."[1]

Cohen's Method.[2] Two fingers, the index and medius, are introduced into the os and made to penetrate between the placenta and the uterine wall in that direction offering least resistance, until the membranes are reached; the fingers are hooked over the border of the placenta, the membranes ruptured, and the corresponding semicircle of placental attachment is broken, and the placental flap thus made is drawn toward the vagina so as to project from the mouth of the womb.

Rupture of the Membranes. The method is generally known as that of Puzos. This obstetrician, in 1759, described his treatment of placenta prævia as consisting in dilatation of the os with his finger,

[1] The writer advocated this treatment several years ago. American Practitioner, 1875, 1876.
[2] Dr. Davis, of Wilkesbarre, Pa., without knowing Dr. Cohen's practice, was led to adopt a similar practice, and has been quite successful with it.

and then rupture of the membranes. According to Auvard, the results of the method of Puzos at the Clinique d'Accouchements and the Maternité were a maternal mortality of 13 per cent. and a fœtal mortality of 46 per cent.

Rupture of the membranes is not in all cases followed by arrest of the hemorrhage. Thus in Müller's statistics it is shown that while bleeding ceased in six cases, in five others it continued or increased. There must be active uterine contractions to secure hæmostasis; if these are not present, or do not follow the discharge of the amnial liquor, the patient's danger is increased by this treatment.

The practitioner will act wisely who adapts his treatment to the conditions of the case; it may be necessary to use the tampon, temporarily at least, in one case, to use dilators in another, to perform podalic version in a third, to apply forceps in a fourth, simply to rupture the membranes in a fifth, or to give ergot, or to combine two or more of the various methods, all these when so used being but means to one end—delivery.

Among other methods of treating placenta prævia may be mentioned that proposed by Dr. W. H. Ford,[1] of St. Louis. This is the performance of Cæsarean section; he limits the application of this treatment to the graver forms of abnormal implantation of the placenta.

In 1894 Bernays,[2] of St. Louis, did this operation successfully in a case of central placenta prævia; the mother made a favorable convalescence, but the child died a few hours after delivery.

Hemorrhage occurring after delivery, a by no means rare sequel in cases of placental prævia, will be considered in the treatment of postpartum hemorrhage.

Premature Detachment in Normal Implantation of the Placenta. Dangerous hemorrhage may result in the latter part of pregnancy, or in labor, from premature detachment of the placenta when this organ occupies its normal situation in the uterus. The hemorrhage may be either open or concealed. The following history of a case of the former variety which occurred during my term of service at the Philadelphia Hospital has been furnished me by the resident physician, Dr. John Chalmers Da Costa, under whose charge she was:

J. L., thirty years of age, multigravida, when at the end of the seventh month of pregnancy, slipped and fell, the right iliac region striking a boiler. She immediately had severe pain, and blood flowed from the uterus to the amount of nearly a quart in a few minutes, then stopped. The finger readily entered the external and then the internal os. The pulse was rapid and very weak; the expression anxious; body agitated with tremors and covered with cold sweat; pupils dilated; heart's action weak, irregular, and beats intermittent; respiration shallow and hurried. Immediately upon being placed in bed she was given whiskey and aromatic spirit of ammonia; the head of the bed was lowered by raising the foot; the vagina was washed out with a hot solution of corrosive sublimate, and opium given freely. The hemorrhage did not return, and the pain gradually subsided in two days. The pregnancy went to term, when she was delivered of a healthy, well-developed child.

This history shows that a grave uterine hemorrhage does not necessarily arrest the pregnancy. It also shows that traumatism may be an

[1] American Gynecological Journal, September, 1892.
[2] Journal of the American Medical Association, May, 1894.

important cause of accidental hemorrhage. It may also occur from acute infectious diseases, as variola, scarlatina, and acute yellow atrophy of the liver. Lifting a heavy weight, severe vomiting, abnormal shortness of the cord, violent coughing, and straining at stool have been given as causes. But the most frequent cause is disease of the placenta; in rare instances hæmophilia has been the cause.

In some instances the cause of the premature detachment of the placenta was the usual contractions of the uterus in pregnancy. But, as suggested by Kaltenbach, in such cases there must be assumed some change in the inner portion of the serotina, rendering its vessels unusually brittle and readily torn. Winter and Fehling have found a connection between nephritis and premature separation of the placenta; the latter regards the more frequent occurrence of white fibrinous infarcts of the placenta in nephritis as the cause of premature detachment. Von Weiss[1] describes a small-celled infiltration of the endometrium, with peculiar changes of the decidual cells; he saw a typical case of numerous fresh infarcts in premature placental separation. Veit maintains that we cannot admit nephritis as a cause of the accident without the medium of endometritis.

The hemorrhage may be internal or external. In the former case the blood effused is included between the detached placenta, or that part of it which is separated, in cases of incomplete separation, and the membranes on the one side and the uterine wall on the other. In some cases the placenta may be completely detached except at its border, and a great mass of blood, a retro-placental clot, cause it to project in the uterine cavity. As a rule the bleeding, though internal for a time, becomes also external, and then any doubt as to the nature of the accident, which may have quite suddenly brought the patient in a condition of alarming prostration, with severe pain at some part of the uterus, and the sensation of terrible distention of this organ, is gone.

The prognosis is more favorable in external than in internal bleeding. Labor generally comes on if the hemorrhage occurs in pregnancy. Almost without exception the children perish, and a very large percentage of the mothers, though possibly the statistics of the late Dr. Goodell present too dark a prognosis in regard to maternal mortality. Graefe[2] has reported twelve cases, only ten of the mothers dying, and the statistics of Galabin certainly are much less unfavorable than those of Goodell.

Goodell advised early rupture of the membranes, immediately followed by the application of a very tight binder and compresses to the abdomen, ergot freely, and prompt delivery by forceps or version. The Cæsarean section has been proposed as securing a prompter emptying the uterus than can be had by other means.

Budin[3] believes that expectation is the better course before labor so long as the woman's life does not seem to be compromised.

The mortality of the mothers in the cases collected by Goodell[4] was nearly 51 per cent., and that of the children 94 per cent. Galabin

[1] Ueber vorzeitige Lösung der normal sitzeenden Nachgeburt. Vienna, 1893.
[2] Zeitschr. f. Geburts. und Gynäkol., Bd. xxiii.
[3] Leçons de Clinique Obstétricale.
[4] American Journal of Obstetrics, vol. ii.

states[1] that out of 23,591 deliveries in the Guy's Hospital Lying-in Charity there were 31 cases of accidental hemorrhage, as compared with 41 of placenta prævia; 21 only were serious, and of these there were 5 deaths of mothers from hemorrhage, while the fœtal mortality was 66 per cent.

Treatment. In the less severe forms of accidental hemorrhage active interference is not indicated. The reader will find several cases of accidental hemorrhage recorded by Rigby[2] in which immediate delivery was not attempted; indeed, he insisted upon the different treatment to be pursued in case of accidental hemorrhage from that required when the placenta was at the mouth of the womb, in the latter urging the importance of immediate delivery. The patient will lie with her head low, her body lightly covered, and stimulants be administered as required; the tampon is used if there is external hemorrhage. In grave internal hemorrhage, however, most obstetricians from Baudelocque on to the present, including such names as Goodell, Schröder, and Barnes, have taught that the membranes should be ruptured, and the uterus promptly emptied.

But rupture of the membranes must not be done before the os is dilated; this dilatation may be made by Barnes's dilators, or in some cases by the fingers. Graefe advises, in case dilatation cannot be readily made in the unshortened cervix, the performance of the Cæsarean operation.

As illustrating the greater danger, if the bleeding is internal, of seven cases recently reported by Desprès, Jardine, Maygrier, and Suter, death occurred in three, and in two of the three the hemorrhage was internal. (Neugebauer.)

The danger is not always over though the uterus is emptied. Grapow,[3] in a case of internal hemorrhage, delivered the patient with forceps, and after the delivery a large mass of clots was expelled, the uterus was tamponed, and the patient died, though no fresh hemorrhage occurred after the introduction of the tampon. So, too, a similar case from Schauta's[4] clinic is given, delivery being by podalic version of a recently dead, large child; the completely detached placenta followed the extraction of the child; the uterus was thoroughly tamponed with iodoform gauze, which arrested hemorrhage, but in two hours the woman was dead.

[1] Op. cit.
[2] Op. cit.
[3] Centralblatt f. Gynäkol., 1892.
[4] Ibid, 1893.

CHAPTER II.

DISEASES THAT ARE EXAGGERATIONS OF PHYSIOLOGICAL CONDITIONS OF, OR OTHERWISE DEPENDENT UPON, PREGNANCY.

HYPEREMESIS: obstinate, incoercible, uncontrollable, pernicious vomiting of pregnancy. The[1] common occurrence of some gastric disturbance in the earlier months of pregnancy has been mentioned, and also the hygienic and medical treatment of the less severe cases of the disorder given. We are now concerned with the exaggeration of this affection, an exaggeration which in some cases may be so great that not only the pregnancy but the life of the woman is imperilled.

In about two-thirds of the cases of hyperemesis of pregnancy the disease begins before the end of the third month. In most patients there is at first a gradual passing of the ordinary nausea and vomiting into the severe form of the disorder, and the patient's stomach rejects the simplest food, liquid or solid, in a short time after it is received. It may be you see her take even only ice-water, but with eagerness and relish, and you congratulate her upon retaining it, but her previous experience leads her to reply: "No; it will come up as soon as it gets warm," and the event in a short time verifies the prediction. There may be copious secretion of saliva associated with the emesis, and the dribbling discharge annoys the patient night and day. Change of position, as from the back to the side, or the reverse, will often be the exciting cause of vomiting. The tongue becomes dry, the gums spongy and bleeding, the breath offensive, the thirst immoderate, and the urine scanty and high-colored; the pulse is 90 to 100, or even more frequent. The inability to retain food, and the loss of rest, for even the night gives no intermission to, scarcely remission of, the vomiting, and the distressing nausea, result in a rapid emaciation and loss of strength; the patient, necessarily confined to her bed, may faint upon attempting to stand, or even upon sitting up; her face is sharp, haggard, sometimes of a dusky hue, or oftener remarkably pale; her eyes sunken, the skin frequently cold and clammy; prostrate, and almost utterly hopeless, she may be willing or eager, as relief from her prolonged and severe suffering, to welcome death, whose shadow seems to be resting upon her.

In the above sketch, an endeavor has been made to represent the condition of a patient under my care several years since. She was in her third pregnancy; the two previous ones—I was not then her physician—had been ended by artificial abortion, though the symptoms, according to her own and her husband's statement, were not so grave as now presented. Her condition was so serious that an able and estimable

[1] According to the statistics of Giles, London Obstetrical Society's Transactions, vol. xxxv., "one-third of pregnant women are free from sickness throughout pregnancy."

practitioner who saw her in consultation with me thought that the induction of abortion furnished the only hope, and probably this had been delayed too long. Nevertheless the patient recovered. The vomiting gradually ceased in the sixth month, and at the end of the normal period she gave birth to a healthy, well-developed male child.

But the result is not in all cases so fortunate. Diarrhœa may occur, and hence the emaciation and exhaustion are more rapid and extreme. The patient passes into the second stage of the disease, in which the grave symptoms previously given become graver; "there are slight manifestations of fever;" in some there is acute pain in the head, in the epigastrium, or in one or the other hypochondrium; "the emaciation is frightful, and attacks of syncope are frequent." The third stage succeeds. Vomiting usually ceases, but in some cases continues, blood being mixed with the vomited matters; jaundice occurs; not alone the breath, but the body emits an unpleasant odor; the pulse is from 120 to 140, and is small and thread-like; mental disorder is shown in hallucinations and delirium, and coma closes the scene.

The duration of the disease is in most cases from two to three months. Of the 118 cases collected by Guéniot, 46 died. In the third stage a fatal result is almost inevitable. The disease is, in some instances, complicated[1] with pulmonary tuberculosis, intestinal catarrh, or round gastric ulcer. In some cases spontaneous abortion occurs, and if the patient be not too exhausted, convalescence follows. The vomiting dependent upon the pregnancy should not be confounded with that which may be caused by albuminuria, cancer of the stomach, or tuberculous meningitis; these mistakes have been made.

The older authors, says Jaffé,[2] gave a mortality of 44 per cent. Horwitz had 13 cases, 5 of them fatal; Joulin collected 121 cases, death occurring in 49.

Causes.[3]—The etiology of the vomiting of pregnancy, whether this vomiting be mild or severe, is obscure. Various theories have been proposed. That which has been generally received is, that the gastric disorder is sympathetic;[4] that is, it is caused by sympathy between the uterus and stomach. We now substitute reflex for sympathetic, but thereby add nothing to our knowledge in explaining the phenomenon. Violent vomiting is also observed when the pregnant uterus is subject to severe internal pressure, or in plural pregnancies, or in polyhydramnios; or when the organ has become incarcerated in the pelvis. Hewitt has dwelt especially upon versions and flexions of the uterus as causes. Bennet asserts an important connection between inflammation of the neck of the womb and the vomiting of pregnancy; circumscribed in-

[1] Kormann.

[2] Jaffé: Ueber Hyperemesis gravidarum.

[3] One of the curious facts in regard to the dangerous vomiting of pregnancy is its comparatively rare occurrence among the Germans. Kaltenbach, indeed, has gone so far as to deny the propriety of artificial abortion in the treatment, saying that if there be disease of the stomach, as cancer or ulcer, the vomiting continues after the uterus is emptied; and if the vomiting have a nervous origin, it is amenable to an appropriate causal or psychical treatment without interrupting the pregnancy.

[4] The term sympathetic can be more appropriately applied to the nausea and vomiting of the husband as a consequence of his wife being present, and thus suffering. Seeing another vomit, especially if there be a strong attachment for the one thus affected, and especially, too, if the vomiting be very frequent, may cause vomiting. Possibly, too, there is something to be attributed to unconscious imitation in marital vomiting. Certainly the few facts illustrating this disorder in the husband are not to be regarded as wonderful and mysterious, but admit of a very simple explanation.

flammation of the body of the womb is a cause, according to others; rigidity of the tissues of the cervix, or adhesion of the membranes at the internal os, are causes given by still others. While the influence of at least some of these will be admitted in individual cases, there are cases in which none of them is present. According to Lebert and Rosenthal, in some cases the nausea and vomiting are nervous, partial manifestations of a general nerve inanition; and Barnes refers to the stomach as not the seat of the disease,[1] but "simply that of election for the discharge of superfluous nervous energy;" but these are merely unproved hypotheses.

Giles, op. cit., "regards vomiting as chiefly one mode of manifestation of nervous instability, and so dependent on the interaction of three main factors:

"1. The increased nervous irritability of pregnancy.

"2. A local source of irritation.

"3. A ready efferent channel for nervous energy (the vagi)."

Vinay, in considering the etiology, includes lesions of the uterus, lesions of the stomach, and the state of the nervous system. He maintains that the real cause of obstinate vomiting is the pathological condition of the nervous system, that is, a functional neurosis characterized by an abnormal excitability of the reflexes, and which is probably of hysteric nature.

Certainly, many of the cases have hysterical manifestations, often preceding the vomiting, the latter replacing them, and many of the reported cures have been by such utterly trivial means that they could only have acted suggestively, and others by some profound mental impression.

Treatment. This is dietetic, medical and surgical, and obstetric. When the vomiting is not very severe, a trial of various different articles of food may be made, as previously suggested, with the hope that some one of them may be acceptable to the stomach; but if it be severe, it is better, as so strongly urged by Dr. Busey, not to allow the patient to take anything, not even a lump of ice, by the mouth, the stomach being given absolute rest. Rectal alimentation should be the chief trust. The late Dr. Austin Flint has recorded[2] the case of a patient who lived sixteen months solely by this means. The late Dr. Henry F. Campbell thus successfully[3] treated a lady for the vomiting of pregnancy, continuing the method for fifty-two days; so sanguine was he of its applicability and value that he stated "under the careful and systematic application of rectal alimentation, artificial abortion for the relief of gravid nausea can be banished from practice, even as a last resort." Dr. Busey advises enemata of beef-tea, bromide of potassium, tincture of opium, and brandy every four hours during the first twenty-four or forty-eight hours, and afterward at longer intervals. At the end of forty-eight hours he begins nourishment by the stomach, using milk and lime-water.

Animal broths, peptonized milk, the whites of eggs stirred in water, Leube's pancreatic meat emulsion, and defibrinated blood may also be used for injections into the rectum.

Unfortunately in some of the cases of grave vomiting there is already diarrhœa, and the rectum is intolerant of even so small a quantity as just advised; or again, in other cases after these injections have been

[1] Op. cit. [2] American Practitioner, 1878.
[3] Transactions of the American Gynecological Society, vol. iii.

successfully used for several days, such rectal intolerance may result that this method of nourishment must be abandoned.

Blundell suggested "injecting blood into the vessels in case of a high degree of weakness and irritability of the stomach and bowels." He referred, in support of this proposed method, to an experiment he had made upon a dog, into whose jugular vein he injected every day, or every other day, for three weeks, several ounces of blood; the dog was allowed water only, and at the end of the time was in good condition.

Medical and Surgical Treatment. The chief medical and surgical means have been mentioned. In all cases of persistent and severe vomiting a vaginal examination must be made, and where possible, means at once used to correct any uterine displacement that may be present. Alkalies, antispasmodics, laxatives, or stimulants may find useful application. By some practitioners more reliance is placed upon opium, or morphine, than upon other agents. Matthews Duncan commends atropine; Talma, of Utrecht, has recommended nitro-glycerin, one milligramme in the course of the day, given in three doses; Bailly succeeded in relieving an obstinate case of vomiting in pregnancy, by applying to the dorso-lumbar region Chapman's rubber bag filled with ice-water, and a blister to the epigastrium. Cohnstein[1] regards the preparations of bromine as especially useful in the vomiting of the early, not of the late, months; if it is not suitable for the case, the first doses fail to relieve, and it should not be continued. Menthol and orexin are among recent remedies advised; the latter proved in one of my patients without the least value.

Washing out the stomach has in some cases been beneficial, and in others giving food through a stomach-tube. Ahlfeld refers to a case near the end of pregnancy in which the vomiting depended upon excessive uterine distention, that was relieved by puncture of the membranes.

Kohler has cured a case of obstinate hysterical vomiting, by pencilling the fauces with a 10 per cent. solution of muriate of cocaine; the same method might be tried with a fair prospect of occasional success in cases of pregnancy vomiting.

Obstetric Treatment. As these patients generally recover, provided the exhaustion be not too great when the womb is emptied, the induction of abortion or of premature labor may be necessary. The proportion of recoveries after one or the other event is given by Guéniot as two-thirds; and among those who die the death of some is to be attributed to delay in the operation. The induction of premature labor in a case of hyperemesis that persists in spite of the best treatment, and imperils life, need not cause the least hesitation on the part of the practitioner. But the question of abortion is a graver one; it is the certain sacrifice of one life, and, unless absolutely demanded for the saving of the mother's life, is murder. No man should take so serious a responsibility as causing abortion in a case of hyperemesis unless indorsed in his action by a qualified, conscientious consultant. But at the same time he should remember the words of Pajot: "The true,

[1] Cent. f. Gynäk., 1891.

radical treatment of incoercible vomiting in pregnancy is emptying the uterus."[1]

Relaxation of the Pelvic Joints. Swelling and softening of the pubic and sacro-iliac joints occur normally in pregnancy; exaggeration of this condition allowing decided motion is a pathological condition. The pubic is more frequently affected than either of the sacro-iliac joints; the disorder usually occurs in the latter half of pregnancy, generally in the last two months, but Moreau has mentioned a case in which the condition began in the second month; in this patient the relaxation continued for more than two years after delivery. Having once occurred, it may reappear in successive pregnancies. The late Professor Meigs stated that one of his patients, who had been confined twelve times, generally suffered for several weeks, in the latter part of each pregnancy, from relaxation of the pubic joints. On the other hand, one of my patients who in the latter part of her first pregnancy suffered from relaxation of the pubic and of the left sacro-iliac joints, and for nearly a year after delivery was not able to walk, passed through her second pregnancy without any manifestation of the disorder.

Relaxation of the pelvic joints, first described by Hippocrates, begins gradually; there is a feeling of weakness or weariness, especially after walking; this after a time is followed by pain upon exertion, but, after rest, ceases. The pain may be distinctly referred to the joint affected, especially if that be the pubic, and pressure upon it by the finger shows increased sensibility. The patient will protest against exercise, unwisely advised under these circumstances; she will say it causes severe distress near the hips, that her steps are uncertain, and she feels as if there was something "giving way" in the pelvic bones. When she walks her steps are waddling. Barker[2] states that the patient can stand with comparative ease, resting upon one leg or the other, but cannot balance herself upon both legs at once. Abnormal movement in the pubic joint can readily be detected by placing two fingers upon the posterior surface of the joint when the patient is standing, and then having her move the lower limbs alternately; in some cases it may be recognized when the patient is lying in bed. Very frequently there are pain and numbness in the lower limbs. The joint may become very sensitive, so that the slightest movement in bed involving the pelvis is attended with severe suffering, and the unhappy patient is condemned to absolute repose. The relaxation having once begun increases until pregnancy ends. In some cases labor, either natural or artificial, may cause rupture, or, either in pregnancy or in the lying-in, inflammation of the joint may occur. Each of these events, however, is very rare. A guarded prognosis should be given, for while recovery is the rule, it is in some cases very slow, and in few rapid.

Treatment. Rest is of the first importance when this affection occurs in pregnancy. I am quite sure one of my patients was injured by persistent efforts to walk in the last weeks of pregnancy. A prolonged rest, too, is necessary after labor, and when the patient gets up

[1] Arch. de Tocol., Oct. 1889.

[2] Puerperal Diseases.

the joints should be immobilized by a suitable apparatus. Barker states that in all cases he has seen, this immobilization has been effected by a little ingenuity in making and adapting a hip-binder of very strong, coarse cloth. Boyer recommended a girdle of leather. Snelling[1] has suggested sole-leather, properly moulded to the shape. Martin's girdle, according to Bailly, has in several instances immediately corrected abnormal mobility of the pelvic joints, and enabled the patient at once to stand and to walk. A plaster-of-Paris bandage would probably be as efficient and more economical.

Inflammation of the Pelvic Joints. This has sometimes occurred in pregnancy, but oftener after labor; it may follow relaxation, or occur without it. The inflammation usually affects but a single joint. In very rare cases suppuration occurs; thus, Kiwisch evacuated half a pint of thick pus from the pubic joint. Hilton has narrated a case[2] in which inflammation of the sacro-iliac joint followed labor; the inflammation ended in suppuration, but the pus was absorbed.

Rupture of the Pelvic Joints. This is a rare accident; it usually affects the pubic joint, but may also one or both sacro-iliac joints. It is impossible for it to occur in natural delivery or in ordinary obstetric operations unless there be an anterior lesion. The treatment is rest and a firm hip-bandage.

Hydræmia. By this is meant an increase in the serous portion of the blood. Associated with it the red corpuscles are lessened and the proportion of white is greater. Stoltz[3] describes the condition as a serous cachexia, "a cachexia which does not differ from symptomatic dropsy, for example, that which results from organic disease of the heart, in its course and in its ordinary termination. Instead of being connected with a local organic malady, it is the consequence of a vicious composition of the blood, an exaggerated hydræmia."

There may be œdema of the lower limbs only, or it may become general, and there may be, in addition to serous effusion in the connective tissue, effusion also into the great serous cavities, especially in that of the abdomen. The face is puffed, the limbs swelled, the external genital organs much distended, clear, almost transparent, looking like sacs of water. The patient is incapable of exercise from her lower limbs being so swelled, and moreover she is exhausted by slight exertion; there are palpitation of the heart and difficult breathing. In some cases the fœtus dies and premature labor or miscarriage occurs. The urine is abundant and contains no albumin, or only a trace of it; and therefore the condition is not to be confounded with the œdema which may occur in renal disease.

In some cases the effusion into the connective tissue is so great that gangrenous patches may be formed upon the lower limbs or upon the external organs of generation.

Treatment. While we endeavor to improve the nutrition of the patient by suitable diet and the administration of tonics, especially of

[1] American Journal of Obstetrics, vol. ii.
[2] Pain and the Therapeutic Influence of Rest.
[3] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome vii.

iron, and employ occasional derivation to the intestinal canal, or excite increased activity of the kidneys, the most immediately beneficial result is obtained by the use of hot baths. In using the hot bath the temperature of the water should be 98° to 100° F.; the patient remains in the bath for twenty minutes, and during this time drinks half a pint of hot water; immediately after coming out of the bath the skin is quickly and well dried, and she is wrapped in a warm blanket and remains in a warm room, a copious perspiration lasting an hour or more is caused, and the relief is great and immediate. Œdema of the lower limbs is treated by rest in the recumbent position, or, when sitting up, placing the limbs upon a chair; that of the vulva requires frequent cold bathing, possibly in some cases a compress and bandage; in either manifestation of the disease punctures may be necessary to prevent gangrene. In ascites the effusion may be so great that it either must be removed or the pregnancy ended; Cohnstein[1] gives very decided preference to the former, and certainly this is the wiser choice. If there be serous effusion into the thorax, so that there is great interference with respiration, thoracentesis should be done without hesitation, as this operation is well borne by pregnant women. Punctures of the labiæ may be required when the œdema is very great; but, of course, careful antisepsis must be observed in such operation.

Anæmia—Pernicious Anæmia. In the affection which has just been considered there is that which is designated as anæmia. But there may be such anæmia without the grave manifestations that have been described; for example, the œdema if present is only slight. In addition to the discomforts of the condition, it carries with it future dangers, especially that of post-partum hemorrhage. Hence the importance of improving the character of the blood by proper diet, by correcting any digestive disorder that may be present, and especially by giving an iron tonic; the prophylactic treatment of some cases of post-partum hemorrhage ought to begin in pregnancy.

Pernicious anæmia is a much rarer and graver disease. In 1858, Dr. Barclay[2] published the report of a case of anæmia, the disorder occurring in the puerperal state, and proving fatal the fifth month after delivery. Addison, in 1855,[3] described a grave form of anæmia, which he termed idiopathic. Lebert, in 1853, recorded cases of fatal puerperal chlorosis at Zurich, where subsequent observations were made by Gusserow and Biermer; he regarded them as examples of essential anæmia. Biermer, in 1871,[4] published an account of 15 cases of what he termed progressive pernicious anæmia; and Gusserow five cases of this disease in pregnant women. Coupland[5] collected 110 cases, 54 of the subjects being females, and in 20 of these the starting-point of the pernicious anæmia was pregnancy.

Causes and Symptoms. Malaria, insufficient or improper food, multiparity, obstinate vomiting, hemorrhage, violent emotion, mental shock, and diarrhœa are among the alleged causes in some cases. In other cases no explanation of the occurrence of the malady could be

[1] Op. cit.
[2] Medical Times, 1851.
[3] Sydenham Society's edition of Addison's Works, p. 212.
[4] Ziemssen's Cyclopædia, vol. xvi.
[5] Gulstonian Lectures, 1881.

given. In the majority of cases the disease begins gradually. The face grows more and more pale and presents a waxy appearance; in some cases it is slightly yellow, but it is not emaciated, the patient retaining, for a time at least, her general plumpness of form, for, as Addison remarked, there may be an actual increase in subcutaneous fat. After a time fever occurs, and then there may be some emaciation. The more prominent general symptoms are palpitation of the heart, fainting, headache, generally sleeplessness, but in some drowsiness; hemorrhages are not unusual; there may be epistaxis or bleeding from swelled and spongy gums, the appearance being that of scorbutus; cerebral hemorrhage has been occasionally observed, and cases of retinal hemorrhage have been frequent. Though Charpentier states the latter are rare, Quincke, quoted by Coupland,[1] found such hemorrhage in all but 7 of 31 cases; Sörensen[2] found it in 10 cases out of 11 examined. The urine is abundant, contains no albumin, or only a trace, has a low specific gravity, and is light-colored. Fever, called by Biermer anæmic fever, is a striking characteristic of the disease. The blood shows great deficiency in hæmoglobin, and in case this constituent be lessened to about one-fifth the normal quantity, the disease, according to Quinquaud,[3] invariably has a fatal result. Not only is the quantity of red corpuscles lowered, but here and there micrococci moving about rapidly are found in the blood.[4]

TREATMENT. Good food and tonics, especially iron, are of first importance. Inhalation of oxygen has been tried. Transfusion has been tried several times, but has rarely been beneficial; in one case the number of red globules was less forty-eight hours after than it was before the operation. Interruption of pregnancy, proposed by Gusserow, and approved by Charpentier, is condemned by Kleinwächter as hastening the usual fatal termination of the disease.

In the autumn of 1856, and in the succeeding winter and spring, there occurred in Indianapolis, at that time my home, and its vicinity several cases of what physicians then termed puerperal anæmia, but which has since been described by Gusserow and others as pernicious anæmia; this conclusion, I think, will be drawn by any one who reads the appended description of the disease and compares it with that previously given. Dr. Funkhouser,[5] who treated several of these cases, read a paper before a local society, giving a narrative of them. Having myself seen two patients suffering with puerperal anæmia, and having heard the doctor's paper read, I hoped to have at least the leading facts contained in it to present in this work. But unfortunately he failed to find the paper, and in lieu of it sent me the following note:

"Having been requested to furnish you with a paper upon puerperal anæmia, which I read before the Indianapolis Medical Society in 1857, and the paper having been mislaid, I will endeavor to give from memory the chief facts it contained. There were probably in the city about twenty cases in all of the disease, and all, or nearly all, proved fatal during gestation, in labor, or shortly after. It seemed to me that the disease manifested three forms, (1) purely anæmic, (2) scorbutic, and (3) cachectic. In all there was hemorrhage from some mucous surface, in the scorbutic from the gums. There was total anorexia; the patient suffered from neuralgic pains, they were pallid, exsanguineous, in some cases had

[1] Op. cit.
[2] Archives Générales de Médecine, tome i., 1880.
[3] Ibid., 1879.
[4] Winckel.
[5] The late Dr. Funkhouser was an esteemed practitioner of Indianapolis for nearly forty years; he was graduated at Jefferson Medical College in 1847. He died July, 1886.

a jaundiced hue, and the skin had here and there purplish spots. Generally there was irritability of the stomach, but the most striking feature was an utter aversion to food. Some of the patients had suffered with malarial fever, but in many there was no such history. In many cases premature labor occurred, and it was not uncommon for the fœtus to be dead, both in such labor and in labor at term."

I have merely to add to this note that the disease was chronic, having no correspondence in this respect with acute yellow atrophy of the liver, and that I can recall only two cases in which the patients recovered, and in each instance the recovery occupied several months.

VARICOSE VEINS. The proportion of women who in pregnancy have varicose veins, as has been mentioned, Budin states to be twenty to thirty per cent., but Cazin[1] makes the number one in twenty-one. The latter proportion, I think, from observations made at the Philadelphia Hospital, nearer correct. Varicose veins are found with almost relatively equal number in primigravidæ and in multigravidæ, though less distinct in the former; in the one they appear from the fourth to the fifth month, but in the others from the second to the third. The internal saphena is in most cases first affected, and in some it only is concerned, but the external saphena is frequently secondarily involved. Varicose veins in the majority of cases are found only in the lower limbs, quite as often in the left as in the right; in some cases the disease exists also in the external genital organs, and in a few affects them alone.

Among the causes of varicose veins in pregnancy the following have been alleged: Gravitation, compression of intra-abdominal veins by the uterus, increase of blood, change in its character, and increased vascular tension.

Cazin refers to the case of a cook, quoted by Chaussier, who always knew herself to be pregnant by the development of varices in her lower limbs; this manifestation occurred in the second month. By compressing them she readily produced abortion. Cazin suggests from this incident that the enlarged veins act as a diverticulum for the blood plethora, which not thus provided for would affect the womb and end the pregnancy.

Varicose veins may cause œdema. It results from the internal pressure of the blood being greater than the external pressure upon the vessels. Pregnancy predisposes to eczema, and this tendency is assisted by the patient's scratching the limbs to relieve the itching with which a varicose part is often affected. The scratching may lead to the formation of a varicose ulcer, though this is not frequent, it having been observed but once in forty-seven cases of varicose veins in pregnancy. The treatment of the eczema, usually eczema simplex, and of varicose ulcer, are the same as in the non-pregnant condition.

The most serious complication of varicose veins is rupture. If it be external, an open hemorrhage results; but if internal, and the skin unbroken, the effused blood forms a tumor commonly known as a thrombus. A thrombus of the lower limbs is rare, but one of the external genital organs comparatively frequent; the latter may occur before, during, or after labor; the last form is most frequent. Bryant[2] has reported a case in which a spontaneous subcutaneous rupture of the internal

[1] Archives de Tocologie, 1880–1.

[2] Medical Times and Gazette, 1850.

saphena occurred in a pregnant woman, with the formation of a thrombus on the inner side of the thigh. Cazin met with a similar case, only the rupture was not spontaneous, but caused by violence. The treatment of thrombus is rest, with cold applications to the swelling. The effused blood is usually absorbed, but in occasional instances suppuration occurs. Rupture of a varicose vein with external hemorrhage has occurred from straining at stool, from lifting a heavy weight, standing for a long time, or a prolonged walk, and by a fall or a blow, or from scratching a varicose ulcer. In some cases, however, the rupture has been without obvious cause: for example, when the patient was in bed and asleep. If the opening be from a large vessel and the bleeding be not promptly arrested, death comes very quickly. Several fatal cases have been reported. It should be remembered, in explanation of the rapidly mortal results, that the blood comes not only from the distal, but also from the cardiac side of the opening in the vein.

A pregnant woman who has varicose veins ought to avoid all those causes which may lead to rupture, such as being costive, carrying heavy loads, standing long, etc. She should lie down a part of each day, and, if the veins are very much enlarged, she may wear a flannel bandage when up. She should further be advised as to the best means of arresting the flow, *i. e.*, immediate and firm pressure upon the bleeding point. The professional attendant called to a case of hemorrhage from the rupture of a varicose vein of one of the lower limbs will in most cases succeed in permanently stopping the bleeding by the application of a compress and bandage. Should this treatment fail, a needle is passed into the skin on one side of, then beneath, the bleeding vessel, and finally through the skin on the other side; a figure-of-8 ligature is firmly applied to the projecting ends of the needle; Cazin suggests a *serrefine* if the opening be small.

Pregnancy-kidney. Albuminuria in a pregnant woman is not uncommon. In a few cases it may be the manifestation of a chronic nephritis that was present previously to the gestation, or it may be from an accidental acute nephritis. But the majority of pregnant albuminurics become so because of the pregnancy itself.

Various explanations of the occurrence of this fact have been offered. The pregnancy-kidney, the *Schwangerschaftsniere* of Leyden, has been by some supposed to originate from increased intra-abdominal pressure, from stasis in the renal veins, either from spasm of arteries (Cohnheim), or from pressure upon the ureters (Halbertsma); Leyden denied the existence of inflammation, but regarded ænemia of the kidney, with œdematous swelling, and fatty degeneration of the epithelium, chiefly of the glomeruli, as characteristic (Runge). Kaltenbach has suggested that very probably the irritated condition of the kidneys is caused by pathological metabolic products from the ovum or from the maternal organism (toxalbumin).

Albuminuria and dropsy are characteristic of the disease, which is usually not manifested until the second half of pregnancy, and, as a rule, disappears after the pregnancy is over. The urinary deposit shows cylinders, lymph corpuscles, a few red corpuscles, and fatty degenerated renal epithelium.

Pregnancy nephritis is more frequent in primigravidæ, and more frequent, too, if the uterus contains more than one fœtus.

The prognosis is not unfavorable. For example,[1] in the Charité, Berlin, in 1888–89 there were 1587 deliveries, and of the women ten had pregnancy-kidney, but none of the ten had eclampsia.

Sometimes, however, one affected with the disease may suffer from sudden lessening of the urine and increase of albumin, and eclampsia be threatened.

Eclampsia occurs more frequently in consequence of acute than of chronic nephritis. Severe renal disease in pregnancy is dangerous to the fœtus, the danger arising partly from premature detachment of the placenta, but chiefly the fœtal death is caused by so-called white infarcts of the placenta. Cohn, quoted by Runge, found 84 per cent. of children of mothers suffering with renal disease born macerated or nonviable.

Treatment of Albuminuria in Pregnancy. The most important part of the treatment in milder cases is a milk[2] diet. In graver cases there may be conjoined hot baths, abundant perspiration being secured by the patient remaining in a warm room after coming out of the bath, and drinking freely hot water or hot milk. Winckel has for more than twenty years directed for pregnant women having notable albuminuria, every morning one or more pills, each containing three-fourths of a grain of extract of aloes, and of extract of colocynth. Löhlein has the patient lying in bed to be in the abdomino-lateral position. Borak and Bernheim, in order to stimulate[3] diuresis in severe cases, have used subcutaneous infusion of the so-called normal salt solution; the injection of the solution is made in the nates or abdominal wall, and 500 to 1000 grammes may be injected at one time. Their results have been good. The question as to the interruption of the pregnancy in some cases of albuminuria will be considered hereafter.

[1] Cent. f. Gynäkol., 1891.

[2] The value of the milk diet has been claimed by Rivière, op. cit., to depend especially upon the fact that this food leaves the least possible residue for intestinal putrefaction, such putrefaction of ordinary food leading to the formation of new toxic principles which, entering the blood, are important factors in the production of eclampsia.

[3] Nouv. Arch. d'Obstét. et de Gyn., 1893.

CHAPTER III.

ECLAMPSIA.

Eclampsia — Puerperal Eclampsia — Puerperal Convulsions. Eclampsia is an acute disease occurring in women in pregnancy, in labor, or in childbed, often sudden in its onset, rapid in its progress, characterized by convulsions, with loss of sensation and of consciousness, ending in coma. (Bailly.) The sudden onset is indicated by the word eclampsia, from ἐκλάμπω, to shine out, to flash.

The intimate connection in most cases between this disease and albuminuria suggests that its consideration should immediately follow that of the latter. It belongs to the pathology of pregnancy rather than to that of labor, for though, according to most authorities, it is more frequent in the latter than in the former, it is more serious if it occurs in pregnancy. Possibly, too, as held by Bailly,[1] it is really more frequent in pregnancy, for as labor generally results from eclampsia, many of the cases of the disease may have been reported as occurring in labor, and "statistics often fail in giving information as to whether labor had actually begun before the first convulsion." The disease is most frequent in the last months of pregnancy, though it has been observed as early as the first month. Considering eclampsia as it may occur in pregnancy, in labor, or in childbed, its frequency, according to Kleinwächter[2] and Galabin,[3] is one in 500; Kormann makes the proportion one in 600, Cazeaux one in 200. Corson[4] met with 10 in 3036 cases of labor—that is, about 1 in 300. One can approximate the number of cases of eclampsia by ascertaining the number that died from this disease and multiplying it by four, for in general it may be stated that not more than 25 per cent. of puerperal eclamptics recover. Studying the vital statistics of Philadelphia for this end, and in the way mentioned, it will be found that in 1890 there were 27,858 births, 56 cases of eclampsia; 1891, 29,764 births, 136 cases of eclampsia; and in 1892, 29,826 births and 60 cases of eclampsia. Using the several numbers of eclamptic cases, each as a divisor of the number of births, supposed to be equivalent to labors of the same year, we get the results—1 eclamptic to 495 labors in 1890, 1 to 233 in 1891, and 1 to 498 in 1892.

While we have thus an approximate estimate of the proportion of cases of eclampsia to labors, we have also shown that the frequency of eclampsia varies in different years.

Bidder has recorded[5] 455 cases of eclampsia occurring from 1873 to 1891 in the St. Petersburg Maternity, the proportion of eclamptic cases being 1 in 123 births.

[1] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome xii.
[2] Op. cit.
[3] Op. cit.
[4] New York Medical Journal, May, 1886.
[5] Arch. f. Gynäkol., Band xliv.

Premonitory Symptoms. These occur in almost all cases. The most important are headache, disturbance of vision, and epigastric pain.[1] The first is generally in the forehead, and in some upon one or upon the other side of the forehead; it is rarely in the occiput. Hamilton referred to frontal pain as especially characteristic. At first it is not continuous, but has irregular intermissions, or at least remissions; when it becomes constant the attack is at hand. It is the most frequently manifested premonitory symptom. It is not unusual, if this pain occur several days before the convulsive manifestations, for slight mental disorder to be associated with it, generally simply dulness of intellect or apathy; the patient, too, may be either sleepless or drowsy. Disturbance of vision is observed in very many cases. This at first is usually indistinctness of sight or inability to use the eyes for more than a few minutes at a time; the letters on the page which the patient is reading are blurred, or she cannot take the stitches in the work she is sewing in the right place; she wearies in the effort and lays aside one or the other object. In rare cases more or less complete blindness may be present for hours, or even for days before the attack; in other instances amblyopia, hemiopia, or diplopia is manifested. Epigastric pain is the least frequent of the prodromata. If present, it may be so severe that the patient groans, or even cries out with the suffering; she leans forward to relax the abdominal muscles, and usually has, with the pain, oppression or difficulty in breathing.[2] Other premonitory symptoms have been observed in some cases, such as vertigo, vomiting, ringing in the ears, irritability of temper, and despondency.

Ahlfeld gives among the more important prodromal symptoms, anuria, albuminuria, œdema of the lower limbs, of the genitals, of the skin of the trunk, of the upper limbs, and of the face, especially of the eyelids, slight twitching of the muscles of the face, and slight opisthotonos, and weakness of memory.

The Attack. After a longer or shorter duration of some of the prodromata—their apparent absence in any case probably being from a failure of observation—the convulsive manifestations come abruptly. The patient lying in bed may have been talking to you one minute; the next she is silent, and you see her face in complete repose, her eyes fixed apparently upon some distant object and her body motionless; this is the brief calm which precedes the terrible storm. While you are looking, and possibly, if it is your first experience, wondering why her speech has so suddenly ceased, the storm begins with quick movements of the eyelids and of the nasal alæ, then of all the muscles of the face. The eyelids rapidly open and close, the pupils are dilated and insensible to light, the eyeballs move in various directions, then are half hidden beneath the upper lids, the face turns slowly toward one and

[1] This was mentioned among the premonitory symptoms of eclampsia in the former editions. A few years since there appeared in one of the London medical journals several communications upon this symptom, some writers apparently thinking it was a recent discovery, and others referred to the neglect to mention it in works upon obstetrics. Such criticism could only have been made by those whose obstetric reading was very limited or very careless. For example, Ramsbotham mentioned this symptom, and so did Jacquemier, 1846, and Chailly-Honoré, 1842, and before these Denman. Ramsbotham's words are "severe cramps in the stomach." Velpeau, 1835, states, in referring to premonitory symptoms, "Denman and others have attached great importance to pain in the stomach."

[2] Auvard gives as the principal prodromata disturbance of vision, epigastric pain, the consequence of dyspnœa, and dyspnœa the result of imperfect action of the lungs.

then to the other shoulder, the mouth is distorted, usually deviated to the left. The wave of convulsion extends to the muscles of the trunk and limbs, and a stage of tonic contraction occurs; the body is rigid and the back is arched as from opisthotonos; the lower and upper limbs are rigid and usually extended; the thumb is flexed upon the palm, and the fingers contracted over it. Bailly mentions a case in which at the beginning of numerous convulsive attacks the unhappy patient invariably raised the left arm over her face, almost in the position taken to ward off a threatened blow; and in one of Olshausen's patients, calling the name of her husband immediately preceded the seizure. The diaphragm and thoracic muscles are involved and respiration is arrested; the livid pallor of the face is succeeded by a dusky red hue; the face is swelled and indicates asphyxia; the muscles at the base of the tongue cause this organ to protrude from the half-open mouth, and it is in many cases more or less severely bitten, and then blood mixed with saliva escapes from the mouth. The muscles of the larynx by their contraction prevent the ready escape of air from the compressed chest, and it passes out with a hissing sound. In ten to twenty seconds clonic succeed the tonic convulsions; these begin in the face, then affect the muscles of the body and limbs; the jaws open and close violently and rapidly, the tongue may be again wounded; breathing is stertorous, irregular, and difficult; at each expiration frothy saliva flecked with blood may be thrown in spray over the clothing of the upper part of the body; jerking movements of the muscles of the body and limbs occur rapidly. The sudden transition from calm to storm is not more striking than the rapid transformation of the face and expression; the convulsions destroy every trace of beauty and intelligence that may have been present a few minutes before; the face is disfigured by "horrible grimaces," distorted, discolored, and while calling for pity and active sympathy, may be even hideous or repulsive.

Whether the muscles of organic life are affected by convulsive movements or not, is a question in regard to which difference of opinion exists; if they are, the explanation of the passage of the feces or of urine, occurring in some cases, is obvious; but if they are not, such evacuations are to be attributed to the convulsive action of the diaphragm and of the abdominal muscles. Braxton Hicks[1] states that in one case of eclampsia, occurring in the sixth month of pregnancy, "when an attack of convulsions came on the uterus became intensely firm, and so remained for the space of ten to fifteen minutes without any change, after which it slowly subsided into the ordinary condition of gentle contraction with relaxation." Similar phenomena were observed by him in another case.

There is not an abrupt arrest of the disordered movements of the clonic stage of eclampsia, but they first lessen in violence and frequency, then cease. Their duration is generally from one to two minutes, but it may be five minutes, and Tarnier once found it twenty minutes. According to Cazeaux, the pulse is full and strong at the beginning of the attack, but this is probably not the rule; in either case it becomes

[1] Transactions of the London Obstetrical Society, vol. xxv.

weak, small, and almost imperceptible with the progress of the convulsive phenomena.

During the attack the patient is insensible to the most powerful external excitants; she can neither see, nor hear, nor feel. Coma or stupor follows the clonic convulsions, the duration of the coma being proportional to the severity of the attack. In most cases within half an hour after the convulsive movements have ceased the patient wakens, at first into a sort of semi-consciousness; she looks upon those surrounding her bed, and does not at once recognize them; when the recognition comes, she does not understand the anxiety which their countenances so often betray; her face has a sadly bewildered expression; the past, so far as the convulsions are concerned, is a perpetual blank, and the present a temporary cloud. In rare cases the patient's recovery immediately begins, and is rapid and perfect. But in the majority eclampsia is not limited to a single attack; other attacks generally follow, the intervals varying from a few minutes to several hours; the attacks may be so rapid, the intervals so brief, that the patient passes directly from coma to convulsions without a moment of even partial consciousness intervening. The coma becomes more profound with the successive attacks. It is caused by cerebral congestion; the congestion results from the arrest of respiration and from the impeded return of blood from the brain arising from compression of the jugulars by convulsed muscles of the neck; in addition to cerebral congestion, there may be serous effusion. The number of attacks may be only two or three, or ten to twenty, or there may be one hundred and even more. Charpentier refers to a case observed by Crettet, in which there were one hundred and sixty. Ahlfeld had a patient who recovered after eighty-two attacks, and Olshausen one that died after one hundred and two. Pajot and Bailly have each had a patient in whom more than one hundred convulsive attacks occurred, yet both patients recovered.

The urine, which is usually scanty, in 84 per cent. contains albumin; in some cases it is smoke-colored or red from the presence of blood. The pulse varies in frequency from 100 to 140; even this last number may be exceeded. The temperature[1] progressively increases during the continuance of the attacks; it may reach 104° F., or go even higher, and after death still greater elevation of temperature is usually found.

The elevation of temperature has been by some attributed to the violent and great muscular action, and by others explained as a manifestation of the poisoning.

Terminations. Maternal and Fœtal Mortality. Eclampsia usually terminates within forty-eight hours, and the great majority of patients recover. Death may occur from asphyxia during a prolonged tonic convulsion, but this is rare; the majority of patients die during coma by a "slow asphyxia." Others die from congestion or

[1] Jean Robin (Paris Thesis, 1883) remarks, in referring to the temperature in the diagnosis of eclampsia: "M. Bourneville has shown that the temperature is progressively elevated in eclampsia, and attains even after death the great degree of 109° F." This would be a valuable sign as an element of diagnosis if met with in all cases, for nothing similar occurs in uræmia, where, on the contrary, the temperature is lowered. Unfortunately, in a quite recent observation, it completely failed. We see, in fact, that the temperature did not pass 99.5° F. (Thesis of Caix, Paris.)

Winckel first called attention to elevation of temperature in eclampsia. But both in diagnostic and prognostic value this sign is by no means constant. For example, in a case occurring under my care at the Philadelphia Hospital, and proving fatal, the temperature was usually less than 101°, only once reaching 102°; an hour after death it was 98.8°.

cerebral hemorrhage. Pulmonary œdema is in many the cause; still others perish later from deglutition pneumonia. The eclamptic is more liable to post-partum hemorrhage and to puerperal accidents, and a number surviving the convulsions perish from puerperal infection. Even though the patient should not die from eclampsia or its immediate consequences, her recovery may be incomplete, for diseases[1] of the psycho-motor or psycho-sensorial centres, as amaurosis, aphonia, hemiplegia, neuralgia, psychoses, may follow. "In the Guy's Charity the mortality was 50 per cent. in cases which began before the onset of labor, 25 per cent. in those which began during labor, and only 8 per cent. in those which began after delivery, the total mortality being 25 per cent." Auvard regards the mortality as 25 per cent., while Winckel states that with the improved methods of treatment of the last ten years it is only 7 to 10 per cent. Ahlfeld considers the mortality about 30 per cent., and so, too, Kaltenbach; Löhlein, 19.38; Olshausen, 25; Schauta, 36.50. The fœtal mortality is 26 to 70 per cent. The death of the fœtus may be from placental changes, so frequent in renal diseases, as has been pointed out, especially from hemorrhages involving the placenta, or, it may be caused by asphyxia; and of course such asphyxia will be more liable to occur if the eclamptic attacks are frequent, severe, and prolonged. According to Vinay, the most frequent cause is the poisoning of the maternal blood and the transmission to the fœtus of this poison. He refers to several facts proving the intoxication of the fœtal blood. Children have been born of eclamptic mothers, with rigidity of the muscles, contractures. I have myself witnessed a case of this kind; others born hemiplegic; albumin has been found in the urine of the fœtus; finally, the child has been born in apparently good condition, and in a short time afterward attacked with convulsions similar to those of the mother, and the autopsy often reveals the lesions observed in eclamptic women who have died.

The chance of the fœtus surviving is little better if the mother is attacked during than before labor.

Prognosis. This is more favorable if the disease occurs after labor than during, and especially before labor. It is rendered graver by the frequency and severity of the attacks, by the profoundness of the intervening coma, by the urine being scanty and containing much albumin, by great œdema, and by the temperature steadily increasing; it should be remembered, however, that in some cases eclampsia proves fatal, though the temperature may vary little from the normal. Schröder regarded the pulse as furnishing the most important prognostic indication. As long as this remains hard and full, though moderately frequent, there is no immediate danger; but if it be frequent, small, and easily compressed, the prognosis is almost absolutely bad. Kaltenbach regards as especially indicating an unfavorable prognosis, complete anuria, profound stupor, loss of reflex irritability, paralysis, small, frequent pulse, great elevation of temperature, jaundice. The prognosis is more unfavorable if there be a complication, such as cardiac or pulmonary disease. Winckel states that the death of the child improves the prognosis in eclampsia occurring in pregnancy.

[1] Kaltenbach.

In connection with the fact just stated, it is of interest to refer to a paper[1] by Barbour, the report of a case of diminution of albuminuria in pregnancy coincident with the death of the fœtus. The author adduces three similar cases observed by Underhill, McLaren, and Spiegelberg.

Pathological Appearances. Autopsies do not establish the nature of the disease.

In exceptional cases the kidneys may be normal, but in the great majority they present changes characteristic of all forms of nephritis, from the slightest to the gravest. Nevertheless the eclamptic manifestations are not in proportion to the gravity of these changes as ascertained after death. Schauta, in twenty-eight cases of fatal eclampsia, found nine of anæmia of the kidneys; in sixteen the lesions of Bright's disease, and in three the organs were healthy.[2] Vinay observes that the results of microscopic examination prove that in rather a large number of cases of eclampsia the disease can hardly be attributed to a renal lesion.

The brain may frequently show no important change. In some there may be found œdema and anæmia—more rarely hyperæmia and still more seldom hemorrhage.

The lungs may show lobular, more seldom lobar pneumonia, and hemorrhagic infarcts; they are frequently œdematous.

In the liver Nikoroff[3] found scattered thromboses of the interacinous capillary vessels, with necrosis of the liver cells, and hemorrhages, as well as thrombi in the small venous vessels. Further, the liver may, in some cases, present the changes characteristic of acute yellow atrophy. In some cases the ureters have been found greatly dilated.

Etiology. It is necessary to divide the causes of eclampsia into predisposing, exciting, and essential, for only thus can some of the contradictory or exclusive theories of its origin be reconciled.

1. *Predisposing Causes.* Primiparity[4] ranks first among these causes, eclampsia being three or four times more frequent in a first than in other pregnancies. Pluriparity is also a predisposing cause, and thus women pregnant with twins or triplets have ten times greater liability to eclampsia than if the uterus contains but one fœtus. Ahlfeld calls attention to the fact that a short woman, her uterus greatly enlarged, is especially exposed to the disease. Löhlein asserts that women with narrowed pelves are very liable to eclampsia. Hereditary influence has been shown a factor in some cases. The late Dr. George T. Elliot narrates the history of a mother and her four daughters who had eclampsia; and Löhlein mentions the instance of three sisters who suffered similarly.[5] There is in some organizations a liability to neurotic disorder, and this may assist, not cause, eclampsia. Possibly the mental condition may predispose to the affection, and this may explain an increased danger of unmarried women, as held by some. In consequence of in-

[1] Edinburgh Obstetrical Society's Transactions, vol. x.
[2] Ahlfeld in 17 cases of eclampsia had 2 without any disease of the kidneys.
[3] Jahresbricht über die Fortschritte auf dem Gebiete der Geburtshilfe und Gynäkologie, 1894.
[4] In fifteen years, 1874 to 1889, 2655 women were delivered at the Philadelphia Hospital, and there were 9 cases of eclampsia, or 1 in 295. But the 9 were primiparæ. I am indebted to D. J. L. Rothrock, one of the resident physicians at the hospital for furnishing me with these statistics.
[5] Stewart, Lancet, 1893, met with eclampsia in two sisters, each a primipara.

creased reflex excitability of the nervous system the liability to eclampsia is greater.

Exciting Causes. Given a condition of unstable equilibrium, a comparatively trifling cause may destroy that equilibrium; and thus we find in some cases abdominal palpation, or vaginal examination, movements of the child, or a distended bladder may immediately result in an attack. So far as the convulsions follow a uterine contraction, possibly this action of the uterus is not to be explained so much by the local irritation, but by the fact that contraction throws into the maternal circulation from the placenta new poison originating in it or derived from life-changes in the fœtus.

A contribution[1] to the nervous origin of eclampsia has been made by Lantos, from material collected in the obstetric and gynecological clinic of Professor Kegmarszky, at Budapesth. According to Lantos, albuminuria in the course of pregnancy and of labor, independently of all morbid changes in the kidneys, is not a rare phenomenon, and is even very frequent during labor. Eclampsia occurred once in 278 cases, the entire number of labors being 14,815, and 15 died—28.3 per cent. The mortality was greater after artificial delivery. He regards the disease as an acute peripheral epilepsy. The albuminuria and the eclampsia have a common origin; irritation of uterine nerves is reflected to the kidneys and acts upon their vaso-constrictors, and thence albuminuria; or upon the medulla, and convulsions result.

Do not facts previously mentioned, *e. g.*, uterine palpation or vaginal touch, prove the reflex origin of eclampsia? Various agents may cause the explosion of a powder magazine—an electric spark not less than the blazing fire or the lighted match or the falling spark; but without the powder explosion would be impossible. Thus, in the eclamptic, when reflex irritation apparently is the cause of the convulsive seizure, there is a condition of unstable equilibrium resulting from prior cause, and that equilibrium is readily disturbed by an agent which, under ordinary circumstances, would be powerless.

The Essential Cause. The generally accepted view of eclampsia is that it is produced by toxæmia. The theory of blood-poisoning, as Kaltenbach has said, is sustained by the clinical history and by the post-mortem appearances. "The prodromal gastric and cerebral disorders, the rapid and profound disturbances of the action of the brain, the post-mortem elevations of temperature, the character and frequency of diseases of the nervous system which follow, that are similar to the neuroses after typhus and diphtheria, probably caused by a toxalbumin, are best explained by accepting the hypothesis of toxæmia."

What this poison is, or conceding more than one toxic agent, what these poisons are, and what the origin, are questions still unanswered.

We perpetuate in the title uræmic, once generally, and still often, applied to eclampsia, the view that retention of urea in the blood is the essential cause. Winckel has said that there is no evidence of retention of urea in the most important organs, especially in the liver and muscles; on the contrary, these contained less urea than normally, and in cases of eclampsia that recovered the amount of nitrogen excreted in the urine was only equal to the minimum quantity excreted in a state of absolute hunger. While urea is a poison, the quantity necessary to cause serious injury is very great. Though the pregnant woman excretes nearly one-third more than the non-pregnant, at least ten days must elapse without elimination in order that toxic effects can result[2] Moreover, in uræmic poisoning the temperature does not increase, while, as a rule, in the eclamptic it does.

[1] Archiv f. Gyn., vol. xxiii.

[2] Rivière.

When, many years ago, Frerichs, finding the uræmic theory destroyed, suggested that urea was broken up, and ammonia formed, and that this was the toxic agent, the convulsions being ammoniemic, he advised as prophylactic means the administration of vegetable acids, more especially benzoic and citric. The false, misleading name uræmic has been retained; and equally wrong are those doctors who cling to the Frerichs treatment, apparently not knowing that the theory upon which it was founded has long since perished.

Rivière[1] teaches that eclampsia occurs from auto-intoxication, and this doctrine is also held[2] by Auvard. That it contains only part of the truth will be shown in the further discussion of the subject.

The toxæmic theory rests upon the fact that there are constantly developed in life-processes substances which must be eliminated, various organs being concerned in this process of elimination. If one or more of these organs fail in their function, and it is impossible for others to act vicariously, a toxæmia results; hence there is auto-intoxication. Rivière thus presents the foundation of the toxæmic theory of eclampsia:

1. The organism receives and makes without ceasing poisons, which the liver destroys in part, but which are chiefly eliminated by the cutaneous, pulmonary, intestinal, and renal emunctories. The value of these different emunctories is not the same; the renal filter certainly enjoys the preponderating *rôle*.
2. These products of elimination are all toxic, as clearly proved by experiment; but their toxicity constantly varies in the same individual according to the functional state of the different emunctories and according to diverse special conditions.
3. These poisons being multiple and of diverse origins, the intoxication produced by their retention in the organism is and ought to be complex, and may present several forms.
4. Eclampsia is one of the forms of this intoxication.

It seems probable that failure in elimination by the skin, the lungs, and intestines cannot have the important part in the production of eclampsia that belongs to similar failure of the liver and kidneys, and possibly, as Auvard suggests, there is one renal and one hepatic eclampsia. In regard to the poison or poisons which, retained in the system, may cause eclampsia, we are ignorant. Winckel remarks that there are not only great differences in the degree of intoxication, but probably also various poisons, or, at least, one poison arising in different ways in the body of the pregnant woman, which may be the cause of the disease. In connection with this topic the observations of Stumpf[3] should be mentioned. He, from original investigations, concluded that under abnormal processes of decomposition, a substance free from nitrogen, toxic in its action, perhaps acetone, or a body resembling it, reacting to the same tests, may be formed, which produces in its excretion an irritation of the kidneys that may finally cause nephritis, has a destructive effect upon the coloring-matter of the blood, greatly alters the activity of the renal cells, causes sugar to appear in the urine, and produces destruction of the parenchyma of the liver, advancing to acute yellow atrophy with the formation of tyrosin and leucin, and induces coma and convulsions from an irritation of the brain. Nevertheless he does not regard this view as applicable to all cases of eclampsia.

[1] Pathogénie et traitement de l'auto-intoxication eclamptique. Paris, 1888.
[2] Traité pratique d'Accouchements. Paris, 1890.
[3] Winckel.

The disease should be regarded as essentially a toxæmia, the poisoning resulting in some cases from a failure of one or more eliminating organs to exercise perfectly their function. By the light of this theory possibly we may see why in case of the death of the fœtus, if the eclamptic attacks occur in pregnancy, they cease, or if albuminuria has occurred it lessens or disappears. While the fœtus lived it was constantly throwing into the mother's blood materials which ought to be eliminated through her emunctories. But if the fœtus dies, this process no longer goes on, the mother has only to eliminate self-created poisons, and the organs concerned are adequate to this single work, though they failed when the double burden was cast upon them.

Admitting that the poison causing eclampsia may originate in the fœtus or in its appendages, including especially the placenta, we have a partial explanation of the greater frequency of the disease in plural pregnancy, and, as before suggested, of an exciting cause being found in uterine contractions, for these result in more of the poison entering the mother's blood, in consequence of compression of the uterus.

If this view be correct, while still upholding the doctrine of toxæmia as the best explanation of the etiology of puerperal convulsions, the opinion of Rivière that the condition of the blood is from auto-intoxication cannot be fully admitted.

The view upheld by Gerdes and a few others, that the toxic agent is produced by a bacillus—improbable from the fact that such theory presupposes an endometritis, a condition rarely found in the primigravida, while she is much more liable to eclampsia than the multigravida, in whom endometritis oftener occurs—still the essential etiology remains, that is, the disease originates in toxæmia.

Chambrelent has proved[1] that the toxicity of the blood serum of the eclamptic is greatly increased.

Many questions in the causation of eclampsia remain obscure. For example, Why should the disease be more frequent in one year than in another? Why more frequent in some parts of the country than in others?

Influence of Eclampsia upon Pregnancy and upon Labor. The continuance of pregnancy in an eclamptic is quite exceptional, abortion or premature labor usually resulting from the disease. Even in cases in which neither occurs immediately, the fœtus usually dies, though it may not be expelled until several days afterward. The progress of the labor is usually quickened, not because of any increased force of uterine contractions occurring during the convulsive phenomena, but because of the lessened resistance which accompanies the general relaxation occurring in the intervals between the attacks.

Diagnosis. Premonitory symptoms usually herald the disease; in the majority of cases of eclampsia the physician can, if in previous attendance, give a probable prediction as to its coming. Hysterical convulsions will mislead only a careless observer, for the past history of the subject is different; the convulsive phenomena in eclampsia pursue a regular succession, there is order in disorder, but in hysteria they

[1] Gazette hebdom. de Méd. de Bordeaux, 1892.

are irregular, there seems almost a capriciousness in the movements; they may be grotesque, sometimes ludicrous, and the face presents a striking contrast with that of the eclamptic, horribly distorted by the rapid movements of clonic convulsions. In eclampsia the convulsive movements end in coma; in hysteria they may cease with tears or laughter, or with a profuse secretion of urine. A cry heralds the onset of an epileptic attack; the history of the patient tells of previous attacks; the urine does not contain albumin; the coma is brief. If coma result from apoplexy, there will be accompanying paralysis, and the urine does not contain albumin.

TREATMENT. This is divided into prophylaxis, means indicated in case eclampsia should occur, and finally the obstetric management.

PROPHYLAXIS. The preventive treatment is indicated in all cases of decided disorder of the renal function, especially in pregnancy-nephritis. While eclampsia may occur without any albuminuria, and the majority of albuminurics do not become eclamptic, yet the occurrence of albuminuria in gestation, if associated with lessened renal secretion, is always an indication for the use of means to avert threatened danger.

The milk diet, to the exclusion of all other articles of food, should be at once directed. "Milk is a complete aliment, reconstituent, usually digested more quickly and easily than any other," and, as Rivière suggests, does not leave a toxic residue in the intestines which may be absorbed, and from the blood pass to the intestines. Further, let the hot bath, the bathing accompanied by drinking hot water or hot milk, be employed every day, or once in two or three days; especially is the bath indicated if there be notable œdema. The bowels should be moved daily, using the aloes and colocynth pill advised by Winckel. Vinay[1] praises chloral, stating that if albumin is abundant and eclampsia threatened 4 to 5 grammes may be given every twenty-four hours.

He makes the following statement: "I have employed this medicine during a month, conjoined with milk, in a young primipara, who had general anasarca, bronchitis with pulmonary congestion, digestive disorders, and headache; thus she took during her ninth month 120 grammes of chloral, labor occurred at term, no convulsions, and the child was living and healthy."

MEDICAL TREATMENT. Vinay justly remarks[2] that there are malignant forms of eclampsia absolutely fatal, and all means are powerless; there are others that are benign, and recover without reference to the therapeutic means; and still others of mean gravity, and their course and cure are influenced by the treatment. During the attack the obstetrician should see that the clothing of the patient is loose, should forbid efforts, so often unwisely made, with the vain hope of restraining her movements; but at the same time care must be taken to prevent the possible accident of her falling from the bed; injury of the tongue must be guarded against, not by interposing cork, or rubber, or a spoon, or piece of wood between the jaws, but by stretching a soft napkin between them, from one side to the other of the mouth, so as to keep the tongue from protruding.

[1] Traité des maladies de la Grossesse, 1894.

[2] Op. cit.

Some object to the napkin because it prevents the entrance of air, preferring a wooden spoon interposed between the jaws to prevent biting the tongue. But as entrance of air through the nose is not interfered with the objection does not seem valid; moreover, wooden spoons are rarely found in households in this country.

Kaltenbach regards it important to wipe out the pharyngeal cavity with a small sponge fastened to a handle, as well as turning the face to the side, to prevent the entrance of a large quantity of the secretions from the mouth and pharynx, mixed with bloody slime, into the lungs. "If the tongue falls backward during profound coma, it is to be drawn forward, and immediate relief to respiration is thus given." As soon as possible an active cathartic is usually given, and also a stimulating enema.

Bleeding was formerly regarded by most authorities as the essential treatment of eclampsia, but in recent years it is absolutely rejected by some of the best obstetric teachers.

But may there not be an error on the part of those who reject this means, as there was on the part of those who employed it in all cases? Those who always bled in eclampsia were undoubtedly wrong, but is it quite certain that those who never bleed are invariably right? It may be admitted that there are very few cases in which bleeding is advisable, but to say that there are none is, I think, going too far. Venesection instantly removes a certain amount of toxic material from the blood, whereas elimination by normal emunctories is gradual. It relieves renal congestion, which may be the immediate cause of the eclampsia, and cerebral congestion, which may be the consequence of the attack. Moreover, as pointed out by Peter, a dynamic effect, vascular contraction, results from bleeding. If there are not clinical facts proving the value of venesection in eclampsia, then the statistics adduced by Charpentier must be rejected.

The teaching of that wise obstetrician, the late Dr. Fordyce Barker, upon this question, I think, may be accepted: "When the attack occurs before labor, if the pulse be strong and hard, with great fulness of the vascular system, and the appearance of the face indicates vascular congestion, bleed at once." It should be remembered, however, that whether venesection be employed before or during labor, copious depletion is not advisable, the results, according to Charpentier's statistics, being more favorable if it be moderate.

Ahlfeld commends bleeding in pulmonary œdema, and Kaltenbach has said that it has a beneficial effect in strong, plethoric subjects with great cyanosis. Martin, on the other hand, has seen no benefit from it, and Winckel states that he has long since abandoned it, for, even in pulmonary œdema, if venesection be employed it weakens the power of the heart.

The hot bath is warmly recommended by Breus. The patient is kept for half an hour in a bath, the temperature at first being from 100.4° to 104° F.; then the temperature is gradually increased by adding hot water to 113°; she is, after being taken out of the bath, wrapped in hot sheets and blankets. She perspires freely, and the coma and œdema disappear. As before stated, the hot bath is of especial value in averting a threatened attack.

The treatment of eclampsia most generally accepted is the employment of narcosis, in order to lessen the irritability of nervous centres. The agents usually used are morphine, chloral, and chloroform. The first is given hypodermatically, and the last by inhalation. Opiates were administered in eclampsia by some of the older obstetricians, but it is especially to Clark, of Oswego, N. Y., and to G. Veit, of Bonn, that we are indebted for the heroic doses of morphine. Clark directed an injection into the arm of one grain and a half; if the attacks returned at any time within two hours, the dose was repeated, and if the patient is in labor another dose is given in eight hours. Veit gives at first not less than 0.03 to 0.04 centigramme, or 0.463 grain to 0.617; and within four to seven hours increases it to 0.12 to 0.2 centigramme, or 1.85 to 3 grains. The results have been very good. Ahlfeld employs smaller doses, frequently repeated—only one centigramme being administered at a time.

Chloral is warmly advocated by Winckel, and seems an especial favorite with French obstetricians. Winckel advises from one to two grammes dissolved in water, to be given by the rectum after each attack; until the patient is brought under its influence chloroform inhalation is employed; he does not hesitate to administer twelve grammes or more in twenty-four hours. Charpentier[1] begins the treatment by moderate bleeding, then gives by the rectum four grammes of chloral in sixty grammes of quince mucilage.

Vinay recognizes the fact that one of the benefits of chloral is lessening arterial pressure; he believes that the tolerance of the rectum is facilitated by administering it in combination with the yelk of an egg, thus for an injection he directs one hundred grammes of warm milk, four grammes of chloral, and the yelk of one egg.

Chloroform by inhalation is a common practice in eclampsia. It is held that prolonged chloroform anæsthesia is injurious to the subject in that, as stated by Kaltenbach, it leads to acute fatty degeneration of the heart and other organs, and it impairs the activity of the kidneys. Ahlfeld, Dührssen, Runge, and others emphasize the dangers from the continued employment of chloroform, asserting that death in some cases of eclampsia is to be attributed to it.

In some parts of our country the tincture of veratrum viride is regarded as the most important agent in the treatment of eclampsia. It was first thus used by Dr. Baker,[2] of Eufaula, Alabama, in 1859. Long a favorite remedy in the West and South, it has in comparatively recent years become more employed[3] in other parts of our country.

Jewett[4] gives from ten to twenty minims; the smaller dose repeated in half an hour will suffice in the majority of cases. He asserts "experience seems to justify the statement that no convulsion will occur while the patient is sufficiently under veratrum to hold the cardiac pulsations below sixty to the minute." Dr. T. G. Davis, of Bridgeton, N. J., has reported[5] six cases successfully treated by hypodermatic injection of six

[1] Traité pratique des Accouchements. [2] Southern Medical and Surgical Journal, 1859.
[3] See American Journal of Obstetrics, 1871; New York Medical Journal, 1879; and Transactions of the American Gynecological Society, 1887.
[4] Transactions of the American Gynecological Society, 1887.
[5] Philadelphia Medical News, 1893.

drops of tincture of veratrum viride with one-third of a grain of morphine in thirty minims of water, to which six of alcohol had been added. Undoubtedly this combination of veratrum with morphine furnishes one of the most encouraging methods of treating eclampsia. Of course, the dose is repeated if necessary.

In regard to other means, but little need be said. Potassic bromide, from its slowness and its comparative feebleness of action, is to be rejected; moreover, it may be injurious from the potash, because that, according to some views, exercises a toxic influence if a considerable quantity of the salt is administered. The nitrite of amyl, first given[1] by the late Dr. J. F. Jenks, of Philadelphia, in 1872, and recommended by Dr. Robert Barnes in his Lumleian Lecture, 1873, has failed to prove a constantly efficient agent. Most authorities object to pilocarpine on account of the abundant secretion of saliva causing risks to patients in coma, and because of its depressing influence upon the heart. Bricou, quoted by J. Veit, Müller's *Handbuch*, employed pilocarpin in twenty-four cases, and seven women died, four directly through the influence of the drug.

There is hardly time for the action of diuretics, and, according to Vinay, the only one of these deserving consideration is milk. The diuretic action of normal salt solution injected into the connective tissue, and which has been referred to in considering the treatment of albuminuria, the method of Porak and Bernheim, may be employed.

Obstetric Treatment. If labor has begun, hasten dilatation of the os by means of the fingers or some of the rubber-bag dilators, at the same time preventing reflex irritation by anæsthesia. Then deliver by forceps, or by podalic version, or perforation of the child, if it is dead, as soon as practicable without violence.

But shall the practice of Dührssen, forced dilatation, deep cervical incisions, and high forceps, be adopted? Ahlfeld warns against it. Charpentier, more especially considering the induction of premature labor, as advocated by Dührssen, states[1] that it should be reserved for some exceptional cases in which the medical treatment has failed. He gives the following statistics of the mortality in eclampsia: After spontaneous labor, 18.96 per cent.; after induced labor, 30.04 per cent.; and after *accouchement forcé*, 40.74 per cent. Kaltenbach regards Cæsarean section as preferable to forced extraction of the child after deep incisions of the cervix and the vaginal vault.

In deciding the question of active obstetric interference if convulsions occur in pregnancy, we must remember that in some cases the convulsions cease, and the pregnancy goes to term, when a living child is born; and that in others the convulsions may cease if the child dies, and then, too, the kidneys usually recover their normal condition, the albuminuria disappearing. Gooch's advice was, "Take care of the convulsions, and let the uterus take care of itself." Runge takes the ground that induction of premature labor is to be rejected, at all events only to be brought in consideration in very severe cases. Winckel regards the induction of labor as unjustifiable. Certainly most practitioners will take the view expressed by Charpentier, rather than immediately arrest the pregnancy.

At the Berlin International Congress, 1890, Halbertsma reported six cases in which the Cæsarean operation was done in eclamptics. Several

[1] Philadelphia Medical Times, 1872.

[2] Nouv. Arch. d'Obstét. et Gyn., 1893.

times since then the operation has been employed, and, according to Vinay, excluding those performed when women were dying, there are now eleven cases, with four deaths. The operation is not indicated if the child be dead, and is justifiable only when the condition of the womb will not permit prompt vaginal delivery and after the failure of medical treatment.

In eclampsia occurring after labor chloral or morphine will probably be used, and in some cases inhalation of chloroform; very good results have here been had, too, by the use of veratrum viride.

Is the Cæsarean operation to be done if a woman is dying, with the hope of saving the child? Possibly we may hasten the mother's death; possibly, too, she may be only apparently dying, and, finally, the uncertainty of the child's continuing to live, exposed to the perils it has been from the mother's condition, unite in giving a negative answer to the question; in order to give an affirmative, there must be the infallibility which Coleridge[1] declared necessary for the performance of the operation in general.

Should the mother die, the delivery of the child by this operation is indicated, unless it can be as quickly delivered through the natural passage. The operation need not be done unless the child has reached the viable age, and is living.

The labor ended, and the convulsions ceased, the coma which may remain will be best treated by diaphoretics and milk diet.

[1] In Coleridge's Table Talk the following passage is found: "I think there are only two things wanting to justify a surgeon in performing the Cæsarean operation: first, that he should possess infallible knowledge of his art; and secondly, that he should be infallibly certain that he is infallible."

CHAPTER IV.

CHRONIC AND ACUTE DISEASES IN PREGNANCY.

Under the head of chronic diseases occurring in gestation will be included those that were present before gestation, or began during it.

Diseases of the Heart. As has been previously stated, hypertrophy of the heart is a normal phenomenon of pregnancy. This has recently been conclusively proved notwithstanding previous disputes.

Dreysel[1] from the examination of 67 hearts of women dying in pregnancy and in lying-in, proved that as a rule both ventricles undergo slight excentric hypertrophy, the left more than the right. Heart hypertrophy prevails in young, strong women, increases with the duration of pregnancy to birth, then at first rapidly lessens, afterward slowly.

It has been thought possible that in exceptional cases normal cardiac, like uterine involution, may be imperfect, and persisting hypertrophy may become permanent in consequence of rapidly recurring pregnancies. Now the tendency of hypertrophy of the left heart is to increase the diameter of the aortic and that of the mitral orifice, and hence valvular insufficiency may result.

The cardiac disease in most cases is rheumatic in origin, and antedated pregnancy, but the latter reveals the former, that is to say, a crippled heart may cause no serious disturbance in the non-pregnant condition, but when pregnancy occurs it is unequal to the increased work thrown upon it, and what Peter has first called cardiopathic accidents result.[2] The pregnant woman's heart, it has been said, beats for two, as her lungs breathe for two. "There is consequently greater pressure in the vascular system of these organs, a necessary congestion, and this new anatomical condition resulting from the needs of hæmatosis for two gives a satisfactory explanation of the suffocations which some pregnant women experience, and of the pulmonary hemorrhages which occur in others." In fourteen cases reported by Peter, the form of lesion in almost all was mitral insufficiency with or without stenosis, and once only in the fourteen was there aortic insufficiency. The time when gravido-cardiac accidents begin, or become very intense, is from the third to the sixth month, generally in the fifth. MacDonald[3] holds that serious symptoms do not usually appear until after the middle of pregnancy; they are apt to be aggravated by exposure to cold or by exertion, and patients suffering from severe cardiac lesions almost always are delivered prematurely.

While the statistics of observers confirm the statement of Peter as to the lesion being more frequently mitral than aortic, yet they do not make the proportion so

[1] Münch. med. Abhand, 1891. [2] Maladies du Cœur, et de la Crosse de l'Aorte, 1883.
[3] Chronic Disease of the Heart in Reference to Pregnancy and Parturition.

great as his statistics did. Thus Berthiot[1] gives only 22 out of 36 as mitral; Porak[2] found 57 mitral, 22 complex, and 13 aortic.

Gravido-cardiac accidents are rarely seen in first pregnancies, but their frequency and severity increase from the second in subsequent pregnancies. The danger from cardiac disease is greatest, probably, in labor;[3] after labor the disorder is lessened. The greatest danger occurs when the cardiac lesions are complex. The lesions ranking next in point of peril are mitral; MacDonald and Porak regard mitral stenosis as presenting the greater, mitral insufficiency the less risk. Aortic insufficiency is extremely dangerous in the latter months of pregnancy and in labor, but, provided the delivery is safely accomplished, the threatening symptoms disappear. The liability to abortion or to premature labor, and to hemorrhage, is very great in the cardiopathic. The placenta is in some cases diseased.

Hygiene. Peter states that a woman with disease of the heart had better not marry. If she is married, she ought not to be a mother. If she has once or twice become a mother with impunity, she ought not to have another pregnancy. If safely delivered, she ought not to nurse her child.

Medical Treatment. In mitral stenosis the tincture of strophanthus has been especially commended by Edinburgh obstetricians.[4] In general the treatment will be symptomatic during pregnancy, especially regulating the various secretions and directing easily digested food.

Obstetric Treatment. Berthiot advises auscultating the heart of a pregnant woman, so that if disease be discovered means may be taken to guard against its accidents. If serious accidents arise before the child is viable, it is justifiable to empty the uterus, and still more is this action right if the period of viability has been reached. Wessner states that in the Berne maternity 25 women suffering with cardiac disease passed through 95 parturitions, and only one died. Winckel, quoting these statistics, says they correspond with his experience, and rejects artificial interruption of pregnancy in the treatment, because we cannot be sure of success, and because "this proceeding entails injurious physical excitement and local irritations, and particularly because it is not certain that the mother's suffering will be relieved by it." When labor occurs, either spontaneously or artificially, art should, as far as can be done without violence, replace uterine and voluntary effort in effecting delivery.

Hart,[5] in the management of the third stage of labor in a patient suffering from mitral stenosis, rejects the use of ergot, and regards a free discharge of blood as favorable. If the circulation becomes embarrassed, push strophanthus and dry-cup over the heart; bleed the patient from the arm if the latter fail.

Disease of the heart does not necessarily contra-indicate anæsthesia in labor. MacDonald[6] claims that chloroform is useful, in that it prevents bearing-down efforts. Vergely, quoted by Dutertre,[7] states that

[1] Grossesse et Maladies du Cœur. [2] Quoted by Charpentier.
[3] Murray estimates that in 22,000 labors, of 282 deaths independent of septic disease, 16 were from diseases of the heart. American Journal of Obstetrics, 1889.
[4] Edinburgh Obstetrical Society's Transactions, vols. xiii. and xiv.
[5] Edinburgh Obstetrical Society's Transactions, vol. xiii. [6] Op. cit.
[7] De l'Emploi du Chloroforme dans les Accouchements Naturels, 1882.

cardiac diseases do not forbid the use of an anæsthetic in labor, and chloroform acts as a sedative to the heart in these affections, and may be given prudently.

Dr. J. C. Webster, of Edinburgh,[1] advises in serious cases of cardiac disease, especially mitral, chloroform in labor and delivery with the forceps; he states that occasional hypodermatics of ether may be needed. He especially recommends the nitrite of amyl, four or five minims inhaled at a time, and refers to its having been first given by Fraser Wright in a case of labor complicated by heart disease. "Its action is to lessen the strain on the heart through the dilatation which it causes in the small peripheral vessels throughout the body, either from paralysis of the muscular fibres of the arterioles or of the vasomotor ganglia in them. Soon after its administration (from twenty to thirty seconds) its effects are seen."

Chronic Infectious Diseases. *Phthisis.* The statistics[2] of the late Dr. Austin Flint, as well as the investigations of Gaulard,[3] show that a large per cent. of women become phthisical during pregnancy. The former has stated that in 11.5 per cent. of women under forty years of age who are affected by phthisis, the disease is developed during gestation, and in $13\frac{62}{87}$ per cent. soon after confinement. According to Gaulard, the puerperal state and lactation determine phthisis in at least three-fourths of the cases of the disease in women. The late Dr. George B. Wood[4] taught that the occurrence of pregnancy undoubtedly, in many instances, arrests for a time the progress of the disease, and that lactation appears to exercise a favorable influence over it. He even held that the disease might be kept at bay for many years by childbearing and nursing, so that occasionally the predisposition appeared to be overcome. Dr. Flint's statistics show that in the majority of cases pregnancy does not show an unfavorable influence. James[5] has maintained that pregnancy has a favorable effect upon phthisis, but that labor and lactation are undoubtedly injurious. But, as Stoltz has said,[6] it is not probable that an exhausting function which involves the entire economy will spare a diseased organ. In many cases the phthisical succumb some weeks or some days after premature delivery. The cases are exceptional in which the health seems to be, or is temporarily, benefited by pregnancy. "The children born of phthisical mothers are usually feeble, often at first become scrofulous, and subsequently tuberculous."[7]

In a few cases the tubercle-bacillus has been found in the placenta and in the fœtus of the mother suffering with pulmonary tuberculosis; this has occurred not only in the human subject, but also in the progeny of some of the inferior animals, *e. g.*, the calf.

Winckel quotes the case reported by Charriére, 1873, of a child born of a phthisical mother, dying the third day of general tuberculosis.

Syphilis. Fournier regards pregnancy as a complication of syphilis:[8] "It complicates it by adding to its own peculiar anæmia, its debilitating influence, its disposition to neuroses, its disorders of nutrition, etc."

[1] The Hospital, June, 1894.
[2] Phthisis.
[3] Quoted by Charpentier.
[4] Treatise on the Practice of Medicine.
[5] Edinburgh Medical Journal, 1886.
[6] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome xvii.
[7] Gaulard.
[8] Leçons Cliniques sur la Syphilis, second edition, 1881.

Abortion or premature labor is a very common consequence of syphilis. Thus out of 414 pregnant women at Lourcine, only 260 arrived at term. Abortion from syphilis is not produced alone in coincidence with contemporary syphilitic manifestations;[1] it often, very often, occurs independent of all actual accident, as an isolated phenomenon, as the sole expression of the diathesis.

The secondary stage of the disease is that which furnishes the greatest liability to abortion; from the fourth month to the end of the second year is, according to Fournier, the time when syphilitic abortions most frequently occur. Thus, a woman who, being syphilitic, becomes pregnant, is more liable to abort than one who, being pregnant, becomes syphilitic. If the contagion is commuicated at the time of the impregnation—that is, the fecundating is the infecting coition—there is great danger of abortion; but if the poison is received after the fourth month the danger is slight, and almost nothing if the infection occurs toward the close of pregnancy. According to excellent authorities, the father may beget syphilitic offspring without the mother being affected. Again, it is held by some, Fournier among the number, that the disease may be transmitted by the fœtus to the mother. The antisyphilitic treatment is indicated in pregnancy if the father be syphilitic, even though the mother has had no manifestations of the disease, but still more if she has such manifestations.

Pneumonia. This is a much more frequent disease of the male than of the female, but in the latter has a one-third greater mortality. It is not frequent in pregnancy. Devilliers and Matton,[2] however, regard the increase of fibrin in the blood as predisposing to it, but this could only be the case in the latter part of pregnancy. The disease is one of great gravity both for the mother and for the child. The high maternal temperature, want of proper oxygenation of the blood, and a less supply of blood to the placenta explain the dangers to the fœtus. A greater mass of blood in the pregnant woman to be purified, and much lessened space for its purification, indicate the danger of the disease to the mother, the lungs made hyperæmic in the effort of the right ventricle to overcome the difficulty, and possibly œdema resulting from the hyperæmia.

Pregnancy is more liable to interruption the further it is advanced when the disease occurs. If abortion or premature labor occur, one-half the mothers die; but if the pregnancy continue, only one in between five and six dies. Martin[3] confirms the statement of Ricau,[4] derived from statistics, that a pneumonia before the one hundred and eightieth day is least dangerous for the mother and the fœtus. Ricau found that in 28 cases of pneumonia in pregnant women, 23 recovered, 6 with, 17 without miscarriage; of 15 others with pneumonia after the one hundred and eightieth day, only 8 recovered, 5 with, 3 without miscarriage, while 7 died.

Chatelain's statistics,[5] quoted by Lepine, include 39 cases. In 10 abortion occurred, and in 9 premature labor was induced; of the 19,

[1] Fournier.
[2] De la Puerpéralité, par le Dr. Raymond.
[3] Zeitschrift für Geburtshülfe und Gynäkologie, 1885.
[4] Paris Thesis, 1874.
[5] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome xxviii.

10 died, and of the remaining 20, 10 also died, the entire mortality being nearly 50 per cent. Ricau states that when pneumonia occurs in the last three months of pregnancy, half the patients die, while death is the exception if the disease occur in the first six months.

Some have advocated the induction of abortion or of premature labor in the treatment of grave cases of pneumonia. Upon theoretical grounds such treatment has been condemned. The evacuation of the uterus, as Kleinwächter has said, suddenly reduces the intra-abdominal pressure, but even if the diaphragm be immediately given greater range, which he doubts, with every inspiration there is a greater flow of blood to the numerous venous branches of the thorax, and also permanent increase of pressure in the pulmonary vessels, and an increased load of venous blood is thrown upon the pulmonary arteries when a considerable portion of the lung is unfit to decarbonize the blood. Charpentier believes that the induction of labor ought not to be absolutely rejected, but reserved for special cases; but Spiegelberg absolutely rejects it in all cases.[1]

Pleurisy. This disease usually terminates favorably, and does not disturb the pregnancy. But if bronchitis be associated with it, or if the pleurisy be double, abortion or premature labor may result. Nevertheless, in all cases pleurisy is a more serious disease in the pregnant than in the non-pregnant, because the effusion for the time lessens the pulmonary capacity, which is, of course, a greater evil to the former than to the latter. Thoracentesis has been done in pregnancy without any injurious effect upon it.

Jaundice. Jaundice may occur in pregnancy in either one of two forms, simple or malignant. The first, observed in the later months, is attributed by Frerichs[2] to pressure of the enlarged uterus, or of the colon distended by fecal matter, upon the bile-duct. Bedford[3] suggests that jaundice in pregnancy may sometimes be in part due to strong mental emotions. The second form of the disease, malignant jaundice, may appear much earlier than the simple form, and is dependent upon very serious structural change in the liver.

Peter[4] explains the jaundice of pregnancy as resulting from an exaggeration of the physiological hyperæmia of the liver. According to Tarnier, the liver of a woman dying in pregnancy or in childbed is enlarged, and there is fatty infiltration between the cells. It is an organ for the elimination of ternary compounds, and its work is greatly increased in pregnancy. When the elimination is deficient infiltration occurs. "But, apart from the benign, there is a malignant jaundice of pregnant women. Some women have a benign jaundice up to a certain time, are suddenly attacked by accidents, which rapidly end in death, and which characterize malignant jaundice. This jaundice is the poisoning of the organism by the accumulation in the blood of bile materials uneliminated by the diseased liver, a poisoning which I call cholemic typhisation."

Acute yellow atrophy of the liver, which is present in malignant jaundice, is supposed to result from a constitutional affection. Buhl regards the hepatic disease as one of the evidences of impaired nutrition

[1] "Fischl has compared the 21 cases collected by Gusserow in which premature labor was induced on account of pulmonary disease, with 21 others in which an expectant treatment was pursued; of the former 15 women died, of the latter only 3."—Spiegelberg.

[2] Clinical Treatise on Diseases of the Liver. [3] Obstetrics [4] Clin. Médicale.

of the entire organism. Wunderlich considers the destructive process in the liver to be caused by an acute pernicious constitutional affection. Duncan[1] states that the disease is not seen oftener than once in 10,000. Its greater relative frequency in pregnant women, and its progressing so rapidly, have been attributed to the fact that pregnancy predisposes to parenchymatous degeneration of the glandular organs, especially of the liver and of the kidneys.

The statistics of Frerichs show not only that females are more liable to the disease than males—in 31 cases 22 were females—but also that pregnancy was a predisposing cause, one-half of those attacked being pregnant. Thiesfelder's statistics[2] show that in 88 cases of acute yellow atrophy of the liver in women the disease appeared in 30 during pregnancy and 3 in the lying-in. Spaeth, finding only two cases in 33,000 pregnant women, concluded that the disease was extremely rare. But Ollivier[3] has said in reply that women suffering from jaundice in pregnancy would be received into general hospitals, and not enter maternities, and that recent observations have shown that grave jaundice in pregnant women is not so rare as those statistics indicate.

The disease has occurred as an epidemic, and is then peculiarly fatal. In nearly two-thirds of the cases abortion or premature labor occurs. Dr. J. W. Underhill[4] regards it "as doubtful whether a well-authenticated case of malignant jaundice occurring in gestation has recovered." On the other hand, Charpentier presents a table of 68 cases; 42 of these patients miscarried, and of these 30 died and 12 recovered, while the remaining 26 were delivered at full term.

Premonitory symptoms are observed in one-half the cases. They may precede the serious manifestations of the disease two or three weeks, but usually only three to five days; they generally indicate acute catarrh of the stomach and bowels. The jaundice is slight, and, Duncan states, may be absent. Great nervous excitement, generally violent pain in the head, delirium, and convulsions are succeeded by prostration and stupor, and then a coma, which ends in death. Abortion or premature labor usually precedes death; in some cases the disease is so rapidly fatal that the uterus does not discharge its contents.

Treatment. The mild form requires little or no medication. It may be advisable to give laxatives and direct an occasional warm bath; in some cases diuretics to assist the eliminating action of the kidneys will be useful. In the grave form of the disease Duncan suggests emptying the uterus as the only thing in the way of treatment. But Charpentier, in view of the disastrous results which have been seen to follow abortion, regards the induction of abortion, or even of premature labor, as out of the question. Cazeaux advises that the woman change her residence. But, if already attacked, this change could do no good.

Chorea. This affection, much more frequent in the female than in the male—the proportion, according to Simon, being three to one—is seldom in pregnancy. In 1868 Barnes[5] could find but 56 cases of chorea as a complication of pregnancy. Fehling, in 1874, found 68 cases.

1 Clinical Lectures on Diseases of Women.
2 Ziemssen's Handbuch.
3 Archives Générales, 1873.
4 Transactions of the American Gynecological Society, vol. vi.
5 London Obstetrical Society's Transactions, vol. x.

Charpentier remarks that in 1600 deliveries at the Clinique there were but two cases of chorea, but recently he has seen a third, in which, however, the disease appeared after delivery. Winckel states that he has seen but one case. The liability to the disease is greater in first than in other pregnancies; the larger number of those affected are between twenty and twenty-five years of age. Chorea may occur in a first and not in a subsequent pregnancy, or it may be manifested in several pregnancies. Previous attacks of the disease, as in childhood, create a liability to it. It usually begins in the first half of gestation and continues until the end of the pregnancy; in rare instances it remains through the puerperal state.

Barnes considers the disease is chiefly dependent upon an altered condition of the blood, but states that in addition to this there is an antecedent condition, a predisposing cause, the nature of which is a matter of speculation. Spiegelberg regarded the cause of chorea, except in cases where a central lesion exists, and others of an hereditary character, as imperfectly understood: "Occasionally it is found in connection with disease of the heart and rheumatism, and possibly some of the central lesions may be connected with embolic processes consequent upon cardiac disease. In many cases no clearly defined cause can be found, and these may be considered reflex neuroses, which may be developed under the influence of predisposition, insufficient nutrition of nerve centres from impoverished blood, and the peripheral irritation from the sexual organs."

Psychical causes—such as fear, sorrow, and anxiety—often have a marked influence in determining an outbreak of the disease, but Trousseau has recorded a case in which chorea ceased with the occurrence of pregnancy.[1] Chorea may begin gradually or suddenly. In most cases the movements are bilateral, and in almost all they cease during sleep. The mortality of chorea in children is, according to Sée, 5.7 per cent., while the statistics of Wenzel show a mortality of 27.3 per cent. in pregnant women. Spiegelberg found in 84 cases 23 deaths. Death occurs from the complications rather than from the disease itself. Chorea in many cases causes abortion or premature labor.

Treatment. The medical treatment includes tonics, the alkaline bromides, opium, hypodermatic morphine, and chloral. Wade[2] narrates a case in which digital dilatation of the os uteri was successful in curing the patient, the pregnancy being uninterrupted. If the fœtus be viable, and the usual means for the relief of the disease have been faithfully tried without benefit, the choreic movements are violent, and the patient's strength is failing, the induction of labor is generally considered by obstetricians advisable. But whether cases occur in which abortion is proper is still an unsettled question.

Hysteria. The Father of Medicine advised marriage as the remedy for hysteria; the value of this treatment has not been confirmed by modern observation. In regard to the influence of pregnancy upon hysteria, no absolute rule can be given, but certainly it does not cure it. In the earlier months the hysterical attacks are usually more frequent and severe, while in the later months the opposite is often seen. Ray-

[1] Bulletin Gén. de Thérap., 1846.
[2] London Obstetrical Society's Transactions, vol. xxii.

mond[1] states that the hysterical may pass through labor without suffering as a common fact which has been mentioned by a number of authors.

Epilepsy. In some cases of epilepsy the convulsive attacks during pregnancy are rarer, but after the pregnancy ends they resume their former frequency; in others no change is observed, while in still others the attacks are more severe. In one case under my own care the attacks were less severe and frequent during the pregnancy, but after puerperal convalescence they resumed their former frequency and severity.

"Obstetricans found that the offspring were most frequently diseased when the mother was epileptic, rather than the father. This is readily intelligible when we remember that the ovum contains an immensely larger amount of substance than the spermatozoon, and can therefore be more frequently infected by microbes and can contain a larger number of them."—Weissman's Significance of Sexual Reproduction.

Acute Infectious Diseases. The premature interruption of pregnancy is not uncommon in the severer of these diseases. This interruption may be, primarily, according to Kaltenbach, in consequence of the fever, irritation of the contraction centres through the blood affected by the fever, or, as Vinay maintains, from the toxines elaborated by the infectious agents, these toxines exciting uterine contractions.

The death of the fœtus may result from the infection passing over to it from the mother, as has been observed in some cases of measles, variola, scarlatina, etc. The high temperature of the fœtus may destroy its life; experiments seem to show that sudden elevations of temperature are dangerous, while if the increase be gradual the fœtus may be unaffected even by a prolonged high temperature. Further, fœtal death may be the result of asphyxia consequent upon the condition of the mother. Finally, decidual hemorrhages, observed by Slavjansky in cholera, may be the cause of fœtal death.

Typhoid Fever. Vinay asserts that gestation is interrupted in 65 per cent. Charpentier gives a table including 322 cases, collected from various authors; in 182 abortion or premature labor occurred. He holds that if premature labor occurs the child may be still-born, or if born alive it is feeble, and death may follow, preceded by the symptoms of typhoid fever.[2]

Murchison[3] stated that, "according to Rokitansky and Niemeyer, pregnancy confers almost entire immunity from enteric fever; but the correctness of this opinion has been denied by Forget, Jenner, Griesinger, and others. I have met with many instances of pregnant females attacked by the disease." He regarded pregnancy as a less serious complication than is commonly supposed. The women generally miscarry or have premature labor, but recovery takes place in the great majority. Savidan[4] has collected 31 cases of typhoid fever in pregnancy, with five deaths. One of the fatal cases was complicated with

[1] Op. cit.

[2] Jaggard, American Journal of Obstetrics, 1889, gives as the causes of interruption of pregnancy from typhoid fever, these: 1. Elevation of maternal temperature, causing death of the fœtus by insolation, or its premature expulsion by thermic irritation of the uterine musculature. 2. Hemorrhagic endometritis. 3. Depression of maternal blood-pressure with asphyxiation of the child. 4. It has been proved that the bacillus of typhoid fever may pass into the blood of the fœtus.

[3] Continued Fevers. Third edition, 1886.

[4] Paris Thesis, 1884.

the obstinate vomiting of pregnancy, and another with, probably, acute yellow atrophy of the liver. In typhus fever only about one-half abort, but the majority even of these recover. Murchison's statistics from 1862 to 1870 include 107 pregnant women suffering from typhus under his care; 49 aborted, and nine of these died.

Cold baths[1] and antipyrine have each been used in the treatment of typhoid fever in pregnant women, and without any injurious effect.

Yellow Fever. Millot[2] notes the fact that when yellow fever appeared at Livourne, in 1804, the only time it has been seen in Italy, all pregnant women perished of black vomit. In general, yellow fever is one of the most dangerous of acute diseases in pregnancy.

I am indebted to my friend, the late Dr. S. M. Bemiss,[3] of New Orleans, for the following conclusions as to the relations of yellow fever and pregnancy.

1. Pregnancy is altogether indifferent as it regards liability to attacks of yellow fever after exposure. My observations on this point are sufficient to justify an opinion that pregnant women are neither more nor less liable to the disease than the non-gravid.
2. When pregnant women are attacked by yellow fever the danger of fatal results is so much increased that one might almost say it is exceptional for recovery to occur. But this strong statement of danger ascribable to pregnancy is applicable to other severe epidemic visitations, and includes all cases treated in hospitals and in the various social conditions of private practice. In recalling the events which have occurred in the ordinary run of private practice in the best districts of this city, I can safely say that I have not lost over thirty-three per cent. of pregnant patients. This is something more than double the percentage of mortality of the non-pregnant. We may, therefore, safely postulate the danger to the pregnant woman as being double that of the non-gravid.
3. The dangers attending pregnancy are to be ascribed to the great liability to abortion and death from hemorrhage. Perhaps liability to suppression of renal secretion and death from uræmia may also be greater. Embolism and thrombosis are quite common events in protracted cases of yellow fever, but I have no recollection of such accidents in any pregnant woman in my practice.
4. The pregnant woman, being attacked by yellow fever and recovering without miscarriage, immunity from future attacks is conferred upon the offspring contained in the womb during the attack. This is an extremely interesting proposition. I regret that I have only three accurate observations which support it, but I believe that further investigations will confirm its truth.
5. The recently delivered woman is more liable to be attacked by yellow fever than one differently circumstanced, both being equally exposed. I cannot establish this proposition by any indisputable facts. It is a current belief among those who have observed much yellow fever that traumatic conditions invite attacks of yellow fever. My own observations support this opinion, and more especially as it relates to the parturient woman.
6. The recently delivered woman, being attacked by yellow fever, encounters an increased degree of danger nearly or quite equal to that of the pregnant woman.

Intermittent Fever. It is a mistake made by some to regard pregnancy as furnishing any immunity from malaria. The opposite opinion—that is, that the condition creates an increased liability to the occurrence of its manifestations—is more probable.

[1] Lyon Médical, 1887. [2] Op. cit.
[3] Dr. Bemiss, as will be at once admitted by all who knew this excellent man and wise physician, was eminently careful and conscientious in his investigations, and hence his conclusions may be readily accepted.

Torti,[1] Doublet,[2] and Osiander[3] mentioned the occurrence of intermittent fever in pregnant women; Doublet spoke of it as quite frequent.

Göth's statistics, quoted by Charpentier, show that 46 of 881 pregnant women suffered from malarial attacks; of the 46, 5 miscarried, 14 had premature labor, and in only 27 the pregnancy was uninterrupted.

Bonfils[4] has collected 140 cases, many of them unpublished. In very many premature labor occurred, but in very few abortion. He found that chronic malarial poisoning manifested its influence, especially by the death of the fœtus and by its insufficient development. In regard to the last point, the weight of the fœtus was found to be 500 grammes under the normal, and its length ten centimetres less than the usual length.

One of the curious[5] facts asserted by different observers is that the fœtus may suffer with intermittent attacks, occurring at the same time with those of the mother; in some instances the attacks have continued after birth, and in all the child had at birth an enlarged spleen.

Goodell and Harris[6] have "related cases in which the fœtus seemed to have been affected by the malarial poison, the mothers stating that they were aware of periodical convulsive movements of the children, their own system being apparently unaffected."

In nine cases the fœtus was thought to be affected by malarial poisoning while in the uterus, according to Bonfils.

The treatment of intermittent fever in pregnancy is the same, so far as the administration of antiperiodics is concerned, as if the patient were not pregnant. There need be no hesitation in giving quinine, for example, and giving it freely, unless some idiosyncrasy forbids its use. The late Dr. Henry F. Campbell referred[7] to "the thousands of pregnant women who daily use the drug to prevent or break the force of paroxysms of fever," without its ever entering the mind of patient or of physician that it has any influence in interrupting pregnancy. If abortion or premature labor follow the use of quinine in malarial fever, the result is, as a rule, that of the disease, not of the medicine.

Cholera. Pregnancy neither exempts from nor predisposes to cholera. Kleinwächter states that this more frequently than any other epidemic disease attacks the pregnant woman, especially in the latter months. Abortion or premature labor is caused in about 60 per cent. According to some, the fœtus, too, may have cholera. The death of the fœtus, if not due to the cause just mentioned, may be attributed to the cramps and spasmodic movements of the abdominal muscles of the mother, producing mechanical pressure; to the absolute diet to which she is

[1] Therapeutice Specialis ad Febres Perniciosas. Venice, 1709.
[2] Nouvelles Recherches de la Fièvre Puerpérale. Paris, 1791.
[3] Beobachtungen Abhandlung und Nachrichten. Tubingen, 1787.
[4] Paris Thesis, 1885.
[5] In a paper by Dr. R. W. Felkin, Edinburgh Obstetrical Society's Transactions, vol. xiv., the author states that it has long been recognized that a fœtus in utero can suffer from a paroxysm of malarial fever, and ague-cake in the fœtus is perfectly familiar to those who have practised in tropical countries. Dr. Felkin further adduces two cases to show that the malarial as the syphilitic poisoning may be communicated from the father, the mother being entirely free from any malaria manifestations both before and after the conception of the child.
[6] American Journal of Obstetrics, vol. ii.
Transactions of American Gynecological Society, vol. v.

subjected; to the loss of the serous portion of the blood, making it unfit for nutrition; some regard asphyxia as the chief, if not the sole, cause of the death of the fœtus; Kleinwächter conjoins with it the great loss of the water of the blood, and the lessened blood-pressure. The prognosis for the mother is also bad, but the pregnant condition furnishes no special therapeutic indications.

In the statistics[1] of Queirel, embracing 67 cases of cholera in pregnant women, 39 died and 28 recovered. If abortion or premature labor occurred, the mortality was about 66 per cent.; but if the pregnancy was not interrupted, the mortality was 50 per cent.

Gaillard, October 1, 1892, regards[2] pregnancy as a very grave complication of cholera. "A pregnant woman is particularly unsuited to resist invasion of germs. She is equally unfit to bear an operation." Hence, even induction of premature labor means, in Dr. Gaillard's opinion, the certain death of the mother in order to give a very small chance of life to the child.

Tipjahoff,[3] 1892, had 7 cases of cholera in pregnant women—in all pregnancy was interrupted, and only one survived.

Variola. This is the most grave of acute infectious diseases which may attack the pregnant woman. According to Curschman,[4] her condition causes a certain predisposition to the disease, and increases its malignancy. The danger to mother and fœtus is very slight in varioloid, but in variola, if confluent, abortion or premature labor usually occurs, and is followed by the death of the mother. If a pregnant woman has the disease, the rule is that her fœtus is also affected, and it may pass through all the stages of the disease in the uterus; in some instances it is born with the disease, while in others it is born apparently well, but is attacked soon after birth. In rare cases an apparently healthy mother gives birth to a child having variola; Curschman explains such cases by the hypothesis that the mother had "variola sine exanthemate," and thus infected the child. When mother and fœtus are both affected, the disease begins earlier in the former, the latter not being attacked until the suppurative stage has begun in the mother. The disease may appear in the fœtus as early as the fourth month. In twin pregnancy, one fœtus may be born with the disease, while the other is entirely free from it.

When the infection takes place early in pregnancy, the dead fœtus is usually expelled in three or four days, but it may remain for as many weeks. In some cases the disease is so severe that the woman dies very early without aborting or having premature labor. The further advanced a woman is in pregnancy, the greater the liability to the disease, and the greater its gravity.

Vaccination of the pregnant woman, if she has not been recently vaccinated, ought to be done when there is the slightest danger of her being exposed to the poison of variola.

In a few cases of successful vaccination of the mother, especially if far advanced in pregnancy, what has been called intra-uterine vaccination of the fœtus occurs; the child proving insusceptible to vaccination after birth.

[1] Gaz. Hebdom. de Science Médicale de Bordeaux, 1887.
[2] Gazette Hebdom. de Méd., October, 1892.
[3] Cent. f. Gynäkol., 1892.
[4] Ziemssen's Encyclopædia.

Scarlatina. This disease, several times observed in the puerperal, has been rarely seen in the pregnant woman. Of 141 cases collected by Olshausen, in only 7 did the disease show itself before labor. In 3 out of 16 cases[1] observed by Boxall, the disease appeared in pregnant women. Nevertheless, it is probable, as suggested by Hervieux,[2] after mentioning a case under his own care in which scarlatina occurred in a woman six months pregnant, and caused abortion, and a similar one observed by Dance, that a great number of other cases of the disease occurring in pregnancy have escaped being properly recorded, but, from the fact that the disease caused abortion or premature delivery, have been regarded as belonging to the puerperal rather than to the pregnant state.

The pregnant, as well as the puerperal condition, adds to the danger of the disease. In an epidemic of scarlatina which occurred in Vienna in 1801, abortion occurred in all pregnant women who were attacked, and the majority died. Bourgeois.

One of Boxall's[3] conclusions is the following: It seems possible that the poison of scarlet fever, like that of smallpox, may occasionally, at any rate, determine premature labor, and even before the symptoms of the disease have had time to develop.

Another of his conclusions is, that if labor occurs during an attack of scarlatina, pains are apt to be feeble throughout, inertia sets in early, and there is a liability to post-partum hemorrhage.

Thomas[4] states that the mortality of scarlatina in adults is greatest in pregnant, in puerperal women, and in invalids.

Rubeola. The number of reported cases of measles in pregnancy is small. Gautier has collected a few,[5] among which is one from Fabricius of Hildanus, having considerable interest. The patient of Fabricius was attacked by measles in the middle of the ninth month of pregnancy, and the fourth day of the disease gave birth to her child, which was covered with the eruption of measles. In a case under my own care, the patient being also in the ninth month of pregnancy, premature labor occurred the third day after the eruption appeared; the child was born apparently well, but in a few days had measles, and the disease proved fatal; the mother recovered. Gautier's conclusions are that the disease predisposes to miscarriage from the death of the fœtus, and that it is not without some peril to the mother. Underhill's[6] conclusions are not materially different.

Erysipelas. This may be a very serious disease for the mother occurring near the end of pregnancy.

Lebedeff found in the skin of a fœtus of a mother suffering with erysipelas cocci corresponding with Fehleisen's. Hence the passing of the specific organisms of the disease from the mother to the fœtus is probable, but authorities do not regard it as proved.

Influenza. Influenza interrupts gestation in many cases. Felkin saw[7] abortion or premature labor occur in six out of seven women

[1] London Obstetrical Society's Transactions, vol. xxx., 1889.
[2] Maladies Puerpérales.
[3] Op. cit.
[4] Zeimssen's Cyclopædia.
[5] Annales de Gynécologie, 1879.
[6] Obstetrical Society of Great Britain and Ireland.
[7] Transactions of the Edinburgh Obstetrical Society, vol. xvii.

attacked with the disease. Fruitnight has[1] given given similar testimony. On the other hand, Ballantyne states[2] that he has seen few miscarriages which he could attribute to influenza. He, however, adds: "Gottschalk and Müller both saw two cases, Mijinleff saw one, and Trossat several in which the gestation was interrupted by influenza; and Ammen observed six in which the fœtus died in utero, and was expelled some weeks later." Vinay says that during the epidemics of 1891 and 1892 he saw influenza in twenty-two pregnant women; in six there was premature labor, and in one he induced labor at the eighth month because of grave pulmonary accidents. He advises, in case uterine pains occur, absolute rest in bed and a rectal injection of twenty-five to thirty drops of laudanum, repeated if necessary. He adds, "The employment of antipyrin, so useful in the uterine colics following delivery, here meets a double indication. That cannot be said of quinine, the administration of which should be restricted, for its action upon the gravid uterus, especially if the contractility of this organ is already modified and rendered more excitable by the disease, cannot be disputed."

Diphtheria. This disease has been rarely observed in pregnant women, and, according to Müller, in the majority of cases it shows no injurious influence upon the life of the fœtus, nor upon the course of the pregnancy. Tracheotomy has been performed, and the gestation gone to term; in another instance Cæsarean section was done after death of the mother, and a living child removed. Pregnancy does not contra-indicate tracheotomy.

Pertussis. A curious observation is credited to Beatty by Müller; A woman advanced in pregnancy suffered with whooping-cough, but labor occurred at the normal time, and after it all the symptoms rapidly disappeared.

[1] New York Journal of Gynecology and Obstetrics, vol. iii.
[2] Transactions of the Edinburgh Obstetrical Society, vol. xix.

CHAPTER V.

DISEASES OF THE SEXUAL ORGANS—URINARY DISORDERS—TRAUMATISMS.

VEGETATIONS OF THE VULVA. Papillary hypertrophy may occur at various parts of the vulval surface, giving rise to wart-like elevations, in the pregnant woman. While probably in the majority of cases these growths have a specific origin, yet in some it is believed that they result from the irritation of parts rendered more vascular by pregnancy, like plants springing up luxuriantly from a moist soil. The proof of their non-specific character is given by the fact that they may spontaneously disappear when the pregnancy is over. They may occupy the nymphæ, the vestibule, the hood of the clitoris, the labia majora, the adjacent skin, the vaginal orifice, and in some cases extend into the vagina.

Vinay advises pencilling the growths, if mild means fail, once or twice a day with a mixture of one part of salicylic acid to fifteen of acetic acid.

Unless large, and so extensive that they obstruct the birth-canal, active treatment in pregnancy is not advisable, for excision might be attended with considerable hemorrhage, and followed by abortion or premature labor, or inflammation of lymphatics or veins. When removed they are very liable to return, and their probable spontaneous disappearance after pregnancy is an additional reason for refraining active treatment. The surfaces affected must be kept apart as much as possible, and disinfectant or astringent solutions applied; one of the best local applications is a solution of carbolic acid. Charpentier states that in two pregnant women these growths disappeared by isolating the affected parts, and applying compresses dipped in Labarraque's solution.

Rapid growth and great volume of the vegetations, the pain they cause, the constant purulent discharge, the interference with walking, working, and sleeping, and finally the danger of hemorrhage are, Vinay says, indications for excision. He adds that these growths, in modifying the texture of the skin upon which they are implanted, predispose to rupture of the perineum and of the labia majora.

The preferable means of removal is the curette, Volkmann's, the patient having been anæsthetized; the operation requires from fifteen to twenty minutes; hemorrhage continuing after it is arrested by compression with antiseptic gauze, or by the application of the thermo-cautery.

PROLAPSE OF THE VAGINA. This is to be treated by astringent injections, by having the bladder frequently emptied, especially if a cystocele is associated with the prolapse, and by wearing a suitable pessary; the elastic ring will in most cases be best; if a pessary cannot be worn, a large tampon of absorbent cotton dipped in a mixture of tannin and glycerin may be used; this tampon should be removed each night and a fresh one introduced in the morning.

Leucorrhœa. It is not uncommon for a pregnant woman to have a more or less abundant milk-like discharge from the vagina; it arises from a simple or catarrhal vaginitis, induced in part by the increased congestion of pregnancy. Another form of vaginitis may also occur; it was first described by Deville in 1844, and called by him granular vaginitis; he believed it peculiar to pregnancy, but it may occur in the non-pregnant, though more frequent in the former condition. It is characterized by the formation of a large number of hemispherical elevations about the size of a hemp-seed upon the vaginal surface, making it rough, by burning and itching, and by a rather profuse yellowish discharge which irritates the parts with which it comes in contact in passing out of the vagina. Other vaginal discharges may be caused by gonorrhœal infection or by cervical endometritis.

Winckel described, in 1871, a condition which he observed in three pregnant women, and which was characterized by the presence upon the vagina of a vast number of transparent cysts, fifteen or twenty being found upon a spot the size of a dollar, and usually associated with hypersecretion; most of the cysts contained gas, and when punctured collapsed with a sound readily heard. He named the disease colpohyperplasia cystica.[1]

The treatment of the vaginal discharges of pregnancy will be, in the slighter cases, by tepid injections of solutions of astringents, as of alum, borax, salts of zinc, etc., or a mixture of creolin, usually one-fourth a teaspoonful to a pint of water; in severer cases, in addition to cleansing injections of a two per cent. solution of carbolic acid, of potassic chlorate, or of common salt, a cotton tampon inclosing half a teaspoonful of powdered alum and of subnitrate of bismuth may be passed to the upper part of the vagina and left there for twelve or twenty-four hours, when, by means of a string which has been tied to it before its introduction, it is removed; the tampon may be repeated the following day. Instead of the dry tampon just advised, one of cotton dipped in a mixture of boric acid and glycerin, 1 to 10, may be used, or of tannin and glycerin. If the vaginitis be gonorrhœal, it will be advisable, beside the means that have been mentioned, to apply with a brush a solution of nitrate of silver to the exposed vaginal wall, or to use injections of a solution of[2] corrosive sublimate; during labor the vagina must be well cleansed, a disinfectant solution being used, so if possible to prevent the contact of any infectious matter with the child's face, lest some of it might find its way to either conjunctiva and a specific conjunctivitis result.

Positional Disorders of the Uterus. *Prolapse and Procidentia.* In prolapse of the uterus the organ is still within the vulval orifice, but if it protrudes from that orifice there is procidentia. The uterus in the fourth month of pregnancy begins to ascend, and most cases of prolapse are thus spontaneously cured. But in the pregnant as in the non-pregnant condition the same causes, such as sudden pressure upon the abdomen, or a fall, or jumping from an elevated position, may, especially if the bladder be full, cause acute uterine prolapse.

[1] See Winckel's work on Diseases of Women for full description.
[2] Runge advises applying a solution of chloride of zinc.

Most cases, however, of prolapse of the uterus in pregnancy are those in which the prolapse was present before the pregnancy, for even procidentia of the uterus does not prevent impregnation, as the organ may be spontaneously replaced when the subject lies down; and further, instances in which coition taking place through the dilated os, fecundation has followed. Hypertrophy of the vaginal portion has sometimes been mistaken for prolapse of the uterus, but the fundus occupies its normal place. Amputation of the cervix occasionally is necessary in this hypertrophy.

Kleinschmidt[1] has narrated a case of prolapse of the uterus in pregnancy, the organ protruding about an inch from the vulva if the patient was erect, when the pregnancy was only six weeks advanced; at six months and a half the protrusion still remained, even when the patient was recumbent, and a bandage was worn to support the organ. Kleinwächter states that in case of considerable prolapse and injudicious treatment, especially if reposition be neglected, the organ may become incarcerated, and the pregnancy thereby be arrested. He denies that it is possible in case of complete prolapse or procidentia for the pregnancy to be completed, because of the injuries to which the organ is exposed. Winckel believes that a complete prolapse of the gravid uterus may occur in the first half of pregnancy, but rejects the reported cases of this accident during labor.

The treatment of prolapse of the uterus is reduction, the recumbent position for the patient, and the wearing of a suitable pessary. In cases of difficult reduction the patient may be anæsthetized, or a solution of cocaine applied previous to the manipulation. Should the pessary not retain the reduced uterus, a large vaginal tampon of absorbent cotton or of prepared lamb's-wool, well covered with an ointment of creolin, may be employed, or antiseptic gauze, and a bandage used to keep it in place. Of course, the tampon is removed at night and a fresh one introduced in the morning before the patient rises. Abortion is indicated if a prolapsed uterus becomes incarcerated.

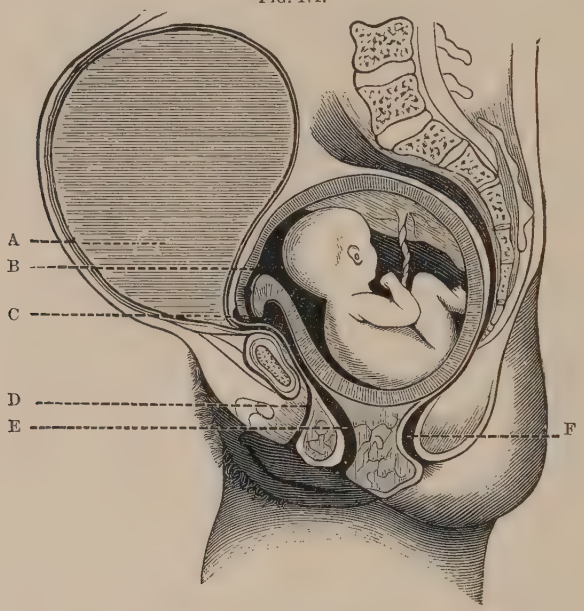
Anteflexion and Anteversion of the Uterus. Anteflexion of the pregnant uterus is an exaggeration of the original condition, and therefore is by most regarded as normal, though very great importance is attached to it as a cause by Graily Hewitt of vomiting; it very seldom reaches such a degree as to be pathological. The rule is that if the uterus be greatly anteflexed sterility results, caused not so much by the displacement, but by conditions associated with it. An anteflexion, or an anteversion, in the earlier months may cause great irritability of the bladder and other inconveniences; but unless some pathological condition be associated with the positional disorder, it is not probable there will be any arrest of pregnancy; nor does it seem possible that the uterus can become incarcerated, and its fundus fixed behind the pubic joint. Anteversion of the uterus is physiological in multigravidæ in the latter part of pregnancy, for the relaxation of the abdominal wall permits the uterus to fall forward; if this relaxation be very great, it may rest upon the thighs when the patient is sitting. The condition is sometimes spoken of as hanging belly, or pendulous abdomen. The occurrence of this accident may occur in diastasis of the recti muscles. Very great discomfort commonly results from this condition in pregnancy, and the entrance of the head of the fœtus into the pelvic cavity be hindered.

[1] American Journal of Obstetrics, vol. xviii.

In labor the uterine contractions work at much disadvantage from the malposition of the womb. The remedy is found in a firm, properly applied bandage.

Retroversion and Retroflexion. Posterior displacements of the uterus in pregnancy are graver conditions. A woman with a retroverted uterus rarely becomes pregnant; hence, if the uterus be found retroverted in pregnancy, it is probably an accident that has occurred after gestation has begun. On the other hand, a woman who has a retroflexed uterus may become pregnant more frequently than one whose uterus is in the

FIG. 171.



RETROFLEXION OF THE GRAVID UTERUS WITH INCARCERATION.

A. Bladder. B. Internal orifice. C. External orifice. D. Urethra. E. Vagina. F. Rectum.

normal position, for the deviation is very often the cause of abortion. In regard to the occurrence of retroversion of the pregnant uterus, there has been much controversy as to whether the deviation is sudden or gradual, and as to whether distention of the bladder is cause or consequence. It may be admitted that each form of displacement can take place—that is, in some cases it is gradual, in others sudden, and that distention of the bladder may occasionally be a cause, while in all cases it is one of the gravest consequences of the change of position.

In the majority of cases of posterior displacement of the gravid uterus spontaneous cure occurs, the uterus gradually rising out of the pelvis. Further, in some cases of retroflexed uterus, as first suggested by Merriman, and as confirmed by the observations of Oldham[1] and Stillé,[2] pregnancy may go on to term, or near it, though the uterus remains retroflexed.

[1] London Obstetrical Society's Transactions, vol. xi. [2] Memorabil., 1881.

Fig. 172.

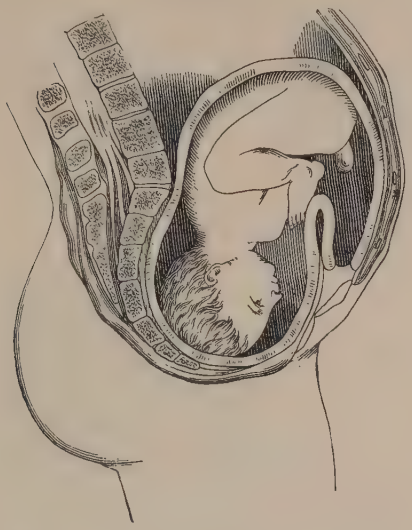


Diagram of Partial Retroflexion. (Oldham.)

Oldham's case was one in which at term he found the head of the child occupying the fundus of the uterus, which was in the pelvic cavity, while the lower segment of the uterus was raised considerably above the pelvic brim. He succeeded in delivering the woman of a dead child, by first introducing the finger into the child's anus, failing to reach the bend of the child's thigh, thus exerting traction, and he was enabled after considerable effort to draw the breech a little lower, and some elevation of the head followed; then pressure upon the lower part of the tumor, while external pressure was made, caused the fundus to ascend above the brim and into the abdominal cavity; the os uteri now being accessible, a foot was brought down, and the child delivered. In Stillé's case a retroflexion at the fourth month of pregnancy caused retention of urine, but no interference with evacuations from the bowels. Replacement being impossible, daily catheterization of the bladder was done; development of the uterus continued, the child's head remaining in the pelvic cavity, the body above. Labor came on seven weeks prematurely, and delivery was accomplished by podalic version.

Further, nature may end the case by abortion; this result is not unfrequent; but, none of the events which have been mentioned occurring, symptoms of incarceration supervene. The uterus confined to the sacral cavity, possibly by the adhesions of an old peritonitis in some cases, continues its development; there result retention of urine and obstruction of the rectum; uræmia and local or general peritonitis may occur; the bladder may rupture, or there may be either a simple or diphtheritic cystitis from retention of urine, and, as a consequence, detachment of the whole or of parts of the vesical mucous membrane.

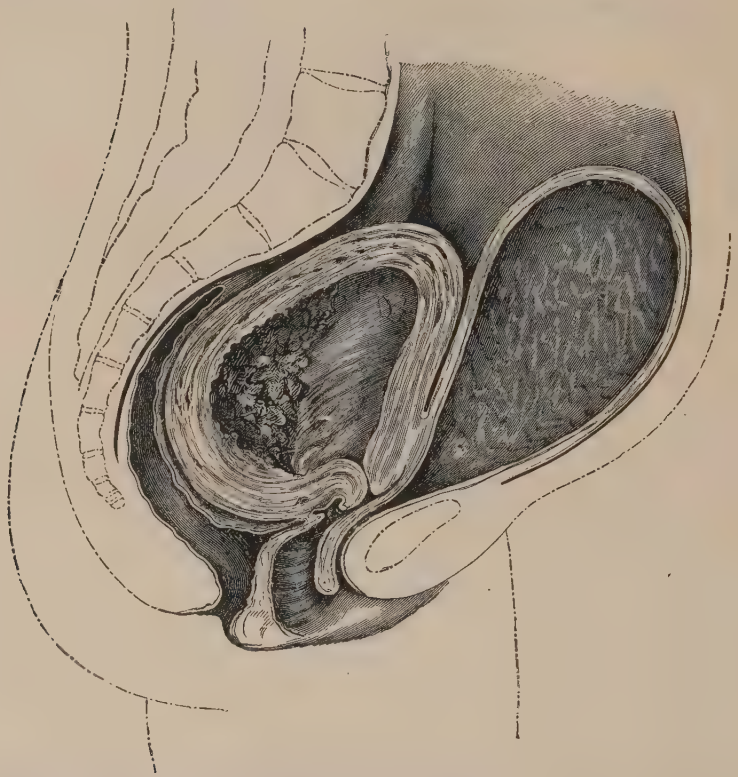
Valenta[1] has reported a case in which retroflexion in the fifth month caused gangrene of the bladder, perforation into the small intestine, and death of the patient.

The diagnosis of retroflexion or of retroversion of the pregnant uterus will not usually present any great difficulty. First, the fact of preg-

[1] See Kormann.

nancy is to be established; next, the bladder is to be emptied,[1] a flexible or a male catheter being used for this purpose, and in case this is impossible aspiration would be preferable to leaving the organ distended; then digital examination by the vagina and by the rectum; and, finally, bimanual examination ought to remove all doubts as to the nature of the disorder.

FIG. 173



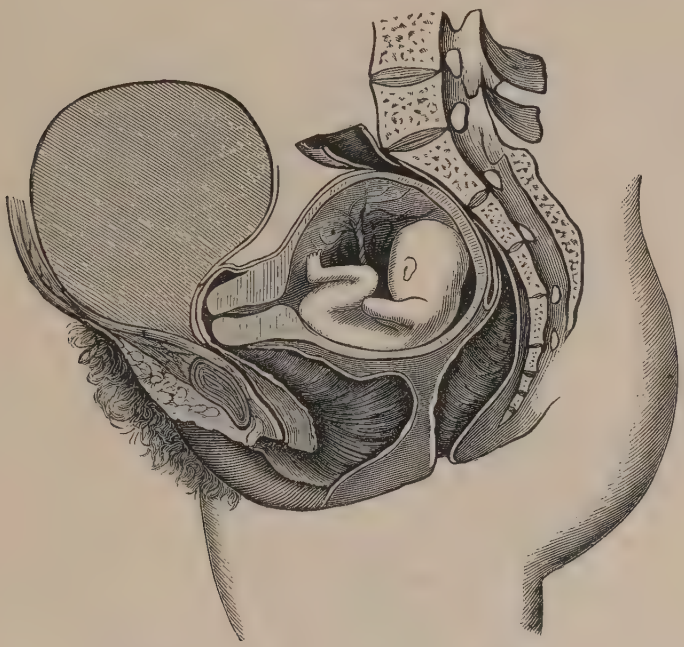
SHOWING UTERUS AND BLADDER FROM A FATAL CASE (DR. CHAMBERS'). SPECIMEN IN ST. THOMAS (ROBERT BARNES).

Having discovered the displacement, the treatment will be, in the simple cases in which the uterus is mobile, digital or bimanual replacement of the organ, and the introduction of a pessary. The patient must avoid compression of the abdomen, constipation, straining at stool, and allowing accumulation of urine in the bladder. She ought each day occupy the knee-chest position, or "the Mahomedan attitude of prayer," for a short time, and when recumbent must take an abdominolateral position. At four months the pessary may be removed. In other cases, the uterus not being mobile, and if no evidences of inflammation are present, efforts at gradual reposition may be made as follows:

[1] The practitioner must remember that in some cases there is ischuria paradoxa, and not let himself be deceived.

Let the patient take the knee-chest position; then the practitioner may, by two fingers introduced into the vagina, press upon the posterior wall of the uterus, or the fingers may exert this pressure through the rectum; no violence should be used; generally immediate reposition is not expected, but a slight gain being made from day to day, final success may be obtained after a week, or even longer time. Another method, either employed alone or assisting that which has been given, is to introduce

FIG. 174.



RETROVERSION OF PREGNANT UTERUS WITH INCARCERATION.

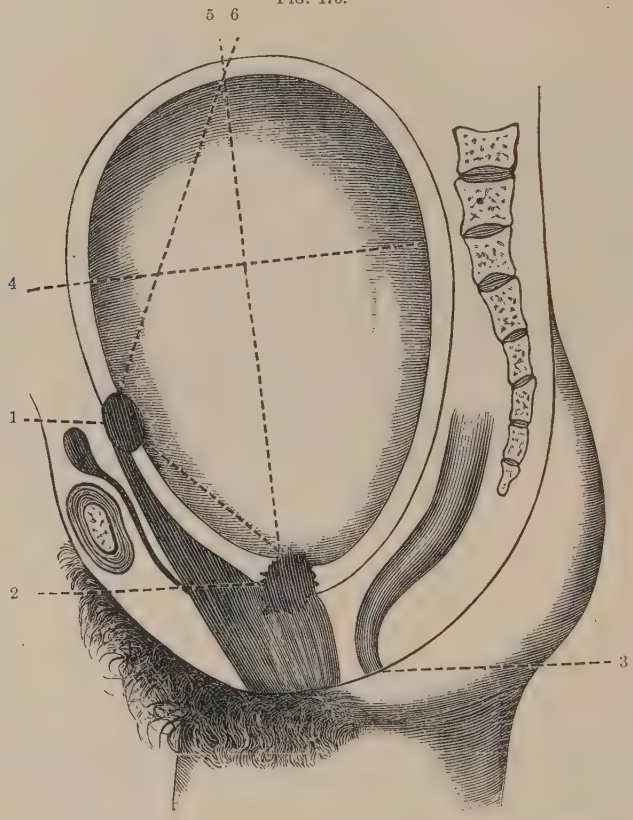
into the vagina the broad blade of Sims's speculum, the broader the better, and with it not only draw back the perineum, but also press up in the posterior vaginal cul-de-sac, thus pushing the body of the uterus up, and at the same time drawing the neck backward; the last may be assisted by seizing the cervix with a tenaculum and drawing it toward the posterior vaginal wall. This entire method may be summarized in *push and pull.* Let the operator, however, always have as his motto, *non vi sed arte.* In manual replacement care is to be taken to direct the fundus of the uterus toward one of the sacro-iliac joints, thus avoiding the sacral promontory.

Another method which counts some success is the use of continuous elastic pressure by means of a rubber bag distended with air or water, introduced into the vagina or into the rectum. But neither organ is very tolerant of such an instrument; this is especially true as to the rectum; moreover, it does more harm than good when the pressure is made through the vagina if the fundus of the uterus be lower than the cervix, for then the pressure will be greater upon the latter than upon the former. I doubt, indeed, whether it is of any value, even

if the uterus is simply transverse; the space furnished by the rectum below the retroverted uterus is so small that but slight force can be exerted through it. If an anæsthetic is used when efforts at reposition are made, of course the patient cannot be in the knee-chest position, but must lie upon her back or upon her side. If reduction be impossible and symptoms of incarceration occur, the only remedy is causing abortion.

In a case of Olshausen's, in which reposition failed because of narrowed osteomalacic pelvis, and puncture through the vagina did not cause abortion, extirpation of the uterus was successfully employed.

FIG. 175.



SACCIFORM DILATATION OF THE POSTERIOR WALL OF THE UTERUS.

1. Os uteri. 2. Artificial os. The distance between the two was about three inches and a half, 9 centimetres. The distance from the fundus of the uterus (6) to the os was 6.7 inches, or 17 centimetres, while that extending from the same point (5) to the new opening was 9 inches, or 23 centimetres. The distance from the os to the median point of the fundus was, following the curve of the anterior wall, 8.2 inches, 21 centimetres, but following the curve of the posterior wall, 18.1 inches, 46 centimetres.

Sacciform Dilatation of the Posterior Wall of the Uterus. A condition rarely observed, and which has been mistaken in some cases for retroversion of the pregnant uterus, was very fully described by Depaul[1] in 1876. It has been called sac-like dilatation of the posterior wall of the uterus. Fig. 175 represents the post-mortem appearance of the uterus of a patient under the care of Depaul.

[1] Archives de Tocologie.

It was impossible for him to find the os uteri, the patient being in labor, and he made an opening through what the autopsy proved to be the posterior wall of the uterus. The patient died undelivered.

Hernia of the Uterus. Ventral Hernia. In rare instances the pregnant uterus has in part protruded at the abdominal ring, the disease being known as uterine exomphalos, or uterine umbilical hernia. In Murray's case[1] more than two-thirds of the uterus thus protruded in the latter part of pregnancy; reduction was readily accomplished, and a bandage prevented reproduction of the hernia. In Oliver's case,[2] not seen until labor began, a cone-like mass—the base of the cone being at the umbilicus—was observed projecting from the abdomen. After the delivery of the child the tumor was still evident, and proved to be the upper portion of the uterus containing an enormously developed placenta, the weight being eight pounds, as estimated after its expulsion.[3] Reduction of the hernia was readily effected. The woman had umbilical hernia in childhood.

Examples of herniæ in pregnancy resulting from dilatation of an abdominal cicatrix have been given by Boivin and others. More frequently, however, herniæ at the linea alba have been observed; separation of the recti muscles occurring, the uterus projects in the interval.

Prochownick, in a recent paper upon diastasis of the abdominal muscles in childbed,[4] states that English women are less liable than German women to pendulous abdomen after confinement, because they remain longer in bed, and especially because they wear well-fitting bandages after getting up. His view as to the disorders that arise in the lying-in from diastasis of the recti muscles will be referred to elsewhere.

The treatment of ventral hernia is the same as that of pendulous abdomen.

Crural and Inguinal Hernia. Winckel[5] remarks that in view of the possibility of the uterus entering into the various canals passing from the false and from the true pelvis, such terms as inguinal hernia of the uterus, crural, obturator, ischiatic, etc., have been used, but as a matter of fact the uterus has been found only in the hernial sac of inguinal and crural herniæ.

Eisenhart[6] states that hernia of the gravid uterus is nearly as rare as hernia of the non-gravid organ; the slight preponderance in number of the former is probably due to the fact that pregnancy directs attention to a condition which would otherwise be unnoticed. In his historical references, he says that Nicolaus Pol, 1531, reported the first case; Cæsarean section was done, the mother survived three days, the child lived to be one year and a half old. In April, 1610, Sennert operated on a case, the mother lived twenty-five days, and the child until nine years and a half old. Saxtorph's and Ledesma's cases are next given; the latter occurred in 1840. Rektorzik reported a case in 1860; the Cæsarean operation was done, the mother died, but the child lived. Inguinal hernia is frequently

[1] London Obstetrical Society's Transactions, vol. i.
[2] Western Journal of Medicine, 1867.
[3] In a private communication Dr. Oliver states that he did not weigh the placenta, but he did the child, its weight being but four and a half pounds, and the placenta seemed to be nearly twice as heavy. The heaviest placenta mentioned in obstetric works, I believe, is that described by Stein, and referred to by Velpeau—its weight being six pounds.
[4] Archiv für Gynäkologie, 1886.
[5] Op. cit.
[6] Archiv für Gynäkologie, 1885.

associated with uterus bicornis or didelphys. In Winckel's case, reported by Eisenhart, the hernia occurred suddenly in the fourth month of pregnancy; the right horn of the uterus was concerned. Scanzoni has reported a case of inguinal hernia in which two pregnancies occurred in one year; one of the pregnancies ended by spontaneous, the other by artificial, abortion.

Adams[1] has collected 23 cases of hernia of the gravid uterus; 9 of these were of inguinal hernia; in one spontaneous delivery occurred, in a second abortion was produced, in a third Porro's operation (Winckel's case), and in the rest the Cæsarean operation; four mothers died, two children lost, including the abortion. One crural, mother died, child saved. Four umbilical, no life lost. Eight ventral, all mothers recovered; craniotomy in one case, and in another the child was stillborn.

In these herniæ Winckel advises abortion. If the fœtus be viable, the Cæsarean section should be done at the end of gestation, and then, if the uterus can be restored to the abdominal cavity, this is done, but if impossible the organ must be removed.

Structural Diseases of the Uterus. Two only of these require consideration, fibroid tumors and malignant growths.

Fibroids of the Uterus. A relative sterility results from fibroid tumors of the uterus; thus while the average sterility of women is one in eight, that of those having these growths is one in three. In the great majority of women having uterine fibroids pregnancy is not interrupted; if the tumors be situated at the fundus, it is thought abortion in the earlier months is very liable to occur; placenta prævia is very much more frequent in cases of fibroids. The tumors usually increase in size, and become softer during pregnancy, and after pregnancy may greatly lessen[2] in bulk; but such changes are observed more especially in those that have a predominance of muscular tissue.

The treatment of fibroid tumors in pregnancy is chiefly symptomatic. Thus, if the tumor becomes incarcerated in the pelvic cavity, an effort is made to push it up in the false pelvis; if hemorrhage occurs, rest, cold drinks, opium, or finally the vaginal tampon may be employed. Miscarriage is almost inevitable.

Many cases of small fibroids do not interfere with the progress of the pregnancy, and, indeed, may not be discovered until after labor is over.

Submucous cervical myomata, it is generally advised, should be enucleated during pregnancy in order to make the birth-canal free and to avoid subsequent necrosis.

The question of producing abortion could only be considered in those cases in which a Cæsarean operation will be necessary at term and the patient refuses it.

In general, the removal of these tumors in pregnancy will be done in just such conditions as imperatively require this operation were the patient not pregnant.

Malignant Diseases of the Uterus. If cancer or sarcoma occupy the fundus of the uterus, there is little probability of pregnancy occurring, and a certainty of abortion should it occur. Cancer of the neck does

[1] American Journal of Obstetrics, 1889.

[2] Dr. Darrach tells me of having many years ago attended a woman in labor, and after the child was born found the uterus so large he believed there was a second child. Waiting two hours, he made a careful examination, and found the enlargement was due to a fibroid tumor. Examining the patient some months after he could find no trace of the tumor.

not present such hindrance to pregnancy, and the latter, provided the malady involves only the vaginal portion, most frequently continues to term. The disease is unfavorably affected by gestation. Should the cancer be limited to the vaginal cervix, and show any progress, amputation ought to be done at once. The operation has been performed in some cases without interruption of the pregnancy. Even when the affection is more extensive and gives rise to copious purulent and hemorrhagic discharges an operation for partial removal of the cervix, taking away all the diseased tissue possible, is proper.

Kaltenbach has reported the case of a woman five months pregnant, who had upon the anterior lip a carcinomatous nodule the size of a hazlenut; it was removed by a wedge-shaped excision, and the pregnancy went to term. Four years later the woman, then in the seventh month of pregnancy, had a similar tumor the size of a walnut in the posterior lip; again a wedge-shaped excision of the diseased portion, and the pregnancy was not interrupted.

If the disease has advanced to the internal os, vaginal extirpation of the uterus is indicated in cases where the pregnancy has not advanced beyond three months. In a case of this kind Olshausen first produced abortion, and then removed the uterus.

The induction of abortion or of premature labor is not generally regarded with favor; nevertheless, in some cases the alternatives are, when labor comes on spontaneously, the Cæsarean operation or craniotomy.

Ovarian Tumors. If an ovarian tumor be small, it usually causes no serious interference with pregnancy; but if the tumor be large, the pregnancy in many cases ends in abortion, or in premature labor. Other accidents are inflammatory adhesions between the tumor and the fundus of the uterus, rupture of the cyst wall, twisting of the pedicle of the tumor, followed probably by hemorrhages into the cyst, and more or less extensive adhesions through which the tumor receives its nourishment. In some cases, when the tumor is not large, it may become wedged in the pelvic cavity.

The treatment of ovarian tumors, so long as they do not give the patient discomfort and threaten the pregnancy, is expectant. But when the tumor is fixed in the true pelvis an effort should be made, with the patient occupying the knee-chest position, to push it out of the pelvic cavity. Large tumors are to be treated by abortion, tapping, or ovariotomy. The first is generally rejected, and the second is only applicable to a monocyst, or to a tumor which is composed chiefly of one cyst. The general professional sentiment is in favor of ovariotomy if the tumor be large; the results are usually good, and especially if the operation be done early in the pregnancy.

Ovariotomy in pregnancy was first suggested by Merriman, in 1817, and was first successfully done by Marion Sims; the operator, however, did not know before the operation was begun that the patient was pregnant.

Ovariotomy in pregnancy has been done by Schröder sixteen times, by Olshausen twenty-six, and Tait, 1889, in thirty cases, in all seventy-two cases, without a death.

In 20 per cent.[1] of cases abortion follows. On the other hand, both Flaischlen

[1] Zeitschrift f. Geburtshülfe und Gynäkologie, 1894.

and Martin have each operated in a case where abortion was threatened, and the danger disappeared with the removal of the tumor.

Complication of labor with an ovarian tumor occurred in the Berlin Frauen-Klinik only five times out of 17,832 labors.

Diseases of the Breasts. Occasionally mastitis is seen in the latter part of pregnancy, the disease being in most cases probably traumatic; Schröder, however, speaks of its occurrence from tumors as exceptional. The treatment is not modified by the pregnant condition, nor does the former have any disturbing influence upon the latter, unless very high fever occurs. Malignant disease of the mammary gland usually makes more rapid progress during pregnancy; hence the indication for removal of the diseased structure without waiting until the pregnancy ends. According to Verneuil, adenomata of the breast are either not affected by or diminish during pregnancy.

Urinary Disorders. *Cystitis.* Inflammation of the bladder is occasionally seen in the pregnant woman. Predisposing cause is given in the participation of the bladder in the congestion of the uterus. Then it may originate from a posterior displacement of the uterus, with consequent retention of urine, or in retention from another cause, and the use of a catheter, perfect antiseptic precautions not being observed.

The tenderness of the bladder and the presence of pus in the urine make the diagnosis easy. There cannot be a cystitis without pus (Guyon). The treatment will be rest, warm baths, drinks to dilute the urine—among these milk is probably the most valuable; diuretics, such as infusion of uva ursi, may be given. Should these means fail, washing out the bladder with a solution of boric acid, 40 to 1000; salicylic acid, 1 to 1000; thymol, or potassic permanganate, 1 to 1000; the last is especially commended by Vinay. My own preference is for creolin, ten drops to a pint; of course, the solution or mixture (in the case of the creolin) is used warm. Hegar's funnel is convenient.

Diabetes Mellitus. This disease has been rarely[1] observed in the pregnant woman. In some cases it originates during pregnancy, but in others it antedates gestation. In all the pregnancy aggravates the disease. Not only this, but the latter injuriously affects the former, the pregnancy in fifty per cent. of cases ending by abortion or premature labor.

The treatment of the disease is the same as in the non-pregnant. The question of arresting the pregnancy is undecided. Fry[2] takes the position that a woman with diabetes should not marry, and regards it as questionable whether marriage ought to be permitted in case of strong hereditary predisposition to the disease.

Nephritis. Chronic renal disease is unfavorably affected by the pregnancy, but often lessens after delivery. In regard to the treatment the subject has been sufficiently considered under the head of albuminuria.

Traumatisms in Pregnancy. Under this title will be included accidental injuries and surgical operations.

Many instances of pregnant women having undergone severe injuries without the gestation being arrested, or in other cases without the loss of life, have been reported. Fractures of the lower limbs, of the pel-

[1] Duncan: Transactions of London Obstetrical Society, vol. xxiv.
[2] Fry: Transactions of the American Gynecological Society, vol. xvi.

vis, and even of the vertebral column have occurred, and the pregnancy gone to term. In one instance a woman seven months pregnant jumped from a third-story window to the pavement, breaking her legs and her arms, yet labor took place at the normal period. In this connection the question as to the delayed repair of fractures in the pregnant may be referred to. Müller[1] regards the question as still an open one. He speaks of the frequently made assertion that fractures of the upper limbs heal readily, while those of the lower limbs do not consolidate until after labor.

I knew of a case in which a fracture of the femur happening to a woman seven months pregnant did not unite until some weeks after she was delivered, and then with unusual deformity. The doctors who treated her were sued, and very heavy damages recovered; but the verdict was set aside.

Dr. R. P. Harris[2] has collected twenty cases of injuries to the abdominal wall, or to it and the pregnant uterus, from the horns of animals, and only seven of the mothers perished and eleven of the children. Frequently injuries have been done the uterus by instruments in attempts to procure abortion, the instrument penetrating the uterine wall. The uterus has been injured by firearms; in rare cases a bullet passing through its wall has also passed through the body of the child.

The most remarkable instance of a minor injury to the fœtus, illustrating, too, the strang migrations of a needle, has been reported by Behm.[3] A pregnant woman accidentally pushed into the abdominal wall a sewing-needle. After the birth of the child the needle was found in its knee.

Amputation of the mammary gland, of a limb, of the vaginal cervix, disarticulation of joints, ovariotomy, herniotomy, etc., have been done many times in pregnant women without the gestation being disturbed; so, too, Emmet's operation for lacerated cervix.

Guéniot[4] has taken the ground that a surgical operation involving the genital zone is contra-indicated, except in urgent cases, by gestation. The chief conclusions in regard to traumatisms, whether accidental or intentional, given by Guéniot are these:

1. The harmlessness of traumatism in pregnancy is not governed by any absolute law.
2. A traumatism, if the woman has no morbid predisposition, she, her uterus, and the ovum healthy, is generally without injurious effect upon the pregnancy.
3. If gestation be complicated with a pathological condition, such as abnormal irritability of the uterus, disease, or great size of the ovum, albuminuria, etc., the traumatism, however slight, and whatever the part involved, most frequently causes premature expulsion of the ovum.
4. Great caution is advisable in performing surgical operations during pregnancy.

Sir James Paget[5] states that while, on the one hand, it would be mere recklessness to operate on a pregnant woman without good cause,

[1] Handbuch der Geburtshülfe.
[2] Abdominal and uterine tolerance in pregnant women under severe lacerated and other wounds from direct violence, 1892.
[3] Quoted by Ahlfeld.
[4] Annales de Gynécol., tome vi.
[5] Clinical Lectures and Essays.

yet if good cause for operation exists she may be treated very successfully.

Tiffany, from a consideration[1] of the relations between pregnancy and operative surgery, presents ten conclusions, the first and last of which are the following:

Pregnancy is a physiological condition, and does not contra-indicate a surgical operation.

When a surgical operation upon a pregnant woman is under consideration the functions of all the patient's organs must be carefully investigated and regulated. An operation then conducted antiseptically may be expected to result as though pregnancy were not present.

Winckel, after recounting many cases of serious injury occurring to pregnant women, or important surgical operations, several occurring in his own practice, performed upon them, gestation usually continuing the normal period, concludes that direct wounds of the uterus and its contents in pregnancy do not necessarily cause the expulsion of the fœtus; indeed, that this is not the usual consequence, and, therefore, if there is a necessity for operating, as favorable results may be expected as if the subject were not pregnant.

Müller refers to the improvements of modern surgery, the great factors of which are narcosis, better technique, and antisepsis, as widening the boundaries of the operative field in pregnancy.

[1] Maryland Medical Journal, January, 1889.

CHAPTER VI.

DISEASES OF THE OVUM—DEATH OF THE FŒTUS—ABORTION—PREMATURE LABOR.

The term ovum includes the membranes—decidua, chorion, and amnion—which compose the fœtal sac, the embryo or fœtus, the placenta, and cord.

Decidual Endometritis. Inflammation of the decidua is very frequent, and in many instances causes abortion. The decidua furnishes,[1] as Martin Saint-Ange expresses it, an incubating chamber for the impregnated ovule, and if the former become diseased injury to the latter is very likely to result. Decidual endometritis may be either acute or chronic. The former is caused by acute febrile diseases, is especially characterized by hemorrhage, and its usual consequence is miscarriage.

Four varieties of chronic decidual endometritis have been described.

1. *Diffuse Decidual Endometritis.* This usually affects the parietal, or uterine decidua, decidua vera, rather than the decidua reflexa, the ovular decidua; it is characterized by the thickening of the decidua from proliferation of the decidual cells and development of the connective tissue; subjacent muscular fibres may also be involved in the hyperplasia.

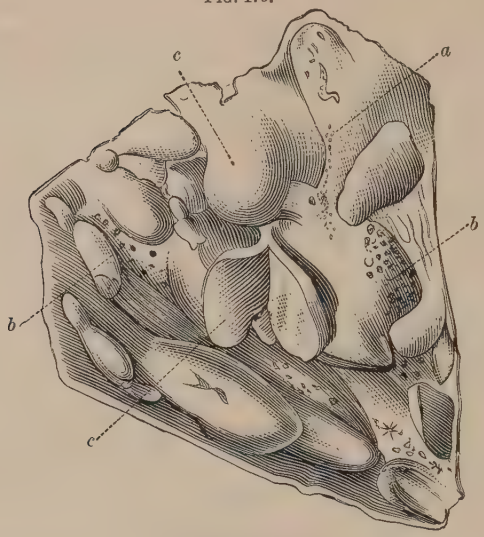
2. *Polypoid Decidual Endometritis.* Here, with chronic proliferation and thickening of the decidua vera, polypoid growths appear; these are about three-fourths of an inch in height, and are broad-based and irregular in form. If polypoid endometritis occur early, the inflammatory process readily extends to the chorial villi, with resulting atrophy of the ovum, and abortion; upon the aborted ova the manifestations of diffuse and of polypoid decidual endometritis may be seen.[2]

3. *Cystic Decidual Endometritis.* In this form of decidual endometritis the inflammation involves the glands of the mucous membrane; the intra-glandular connective tissue is increased and the membrane is swelled; hence, obstruction of the gland ducts and retention of glandular secretion with the formation of cysts. In other words, they are retention-cysts.

4. *Catarrhal Decidual Endometritis.* The characteristic indication of this disease is the discharge from time to time of a watery fluid from the uterus, constituting what is generally known as *hydrorrhœa gravidarum.* The disease is more frequent in multigravidæ than in primigravidæ; it may occur as early as the third month, but usually not until the late months of pregnancy. The fluid is albuminous and generally yellowish, and at times may contain blood. The probability

[1] Iconographie Pathologique de l'Œuf Humain Fécondé.
[2] Archiv für Gynäkologie, 1885. Breus: Ueber cystöse Degeneration der Decidua vera.

FIG. 176.



POLYPOID ENDOMETRITIS.

a. Fine apertures of the glands; *b*. larger apertures of the glands; *c*. protuberances of polypi. (VIRCHOW.)

seems to be that its chief source at least is the uterine glands. At first it appears between the decidua vera and the decidua reflexa, but after these are united the transudation must be between the chorion and the reflexa; the occasional presence of blood in the discharge from the uterus is probably explained as resulting from the fluid, after passing by partial rupture of the decidua to the outside of the ovum in its descent, causing detachment of a part of the decidua from the uterus. Many of the cases of supposed rupture of the membranes, days or weeks before labor, are really examples of hydrorrhœa, a discharge of false waters, not of the amnial liquor, occurring. Slight pains usually accompany the discharge, and in most cases it is repeated several times before pregnancy ends. Premature labor very rarely follows hydrorrhœa, but its possible occurrence indicates that the patient thus affected, especially if there be any uterine contractions, should remain lying down, and in some cases a rectal injection of twenty to thirty drops of laudanum will be advisable.

The symptoms of decidual endometritis are often uncertain. But in some cases the discharge, occasionally bloody, and the sensitiveness of the uterus to abdominal pressure point to the disease. J. Veit regards hyperemesis as often dependent upon the disease.

He states that in consequence of the inflamed condition in the organ there is an increased irritability of the uterine nerves, and hence existence of reflex neuroses. Jaggard has reported[1] a case of obstinate vomiting caused by decidual endometritis.

ATROPHY OF THE DECIDUA. This may affect the decidua vera, or the decidua serotina and reflexa. In hypoplasia the development of the

[1] Journal of the American Medical Association, 1889.

decidua is imperfect. These anomalies of the vera are less important as causes of abortion than if they affect the serotina and the reflexa.

In general, diseases of the decidua do not furnish so much therapeutic indication during pregnancy, as after its interruption they do for treatment of the endometrium in order to prevent a recurrence of the accidents in a new pregnancy.

Anomalies of the Placenta. *Anomalies of Size and of Form.* The relation between the weight of the placenta and the child has been stated on page 129. The placenta is abnormally large in polyhydramnios, in syphilis, and also in the case of a macerated fœtus. The placenta, too, may grow after the death of the fœtus.

The anomalies in the form of the placenta are many. The placenta succenturiata, or subsidiary placenta, has already been mentioned. The union between a placenta succenturiata with the chief placenta is usually by branches of vessels; but if true placental tissue makes the connection, the horseshoe placenta results. Should the subsidiary placenta have the shape of a half-moon, its concave surface turned to the chief placenta, the placental tissue will enclose a space like a window, *placenta fenestrata. Placenta marginata* shows at its fœtal surface a fibrinous ring, which extends from one to two centimetres from the villous tissue; the amnion arises from the inner margin of this ring. Barnes has explained this form of the placenta as originating from the chorion frondosum, occupying only the middle of the placenta and leaving the marginal part bare. Klein, however,[1] regards it as resulting from thickening of the border of the reflexa consequent upon inflammatory changes—decidual endometritis.

Placenta Circumvallata originates thus: If[2] the union of the reflexa and vera is prevented by hypersecretion of the latter or from endometritic processes, the site of placental attachment is small; abortion not occurring, there is formed either a very thick placenta, or it grows so that it forms above the reflexa and vera an exuberant, mushroom-like development.

Structural Anomalies of the Placenta. Cysts varying in size from that of a pea to that of a nut may be found upon the inner surface of the placenta; they usually contain a thin, yellowish fluid.

Calcareous concretions are not uncommon. Chemical analysis shows the deposit to be composed of carbonate and phosphate of lime; Robin found also phosphate of magnesia. These calcareous formations occur both in the maternal and fœtal portions of the placenta.

It is usually stated that such deposits are without any importance. But recently, however, in some cases of premature detachment of the normally situated placenta the deposits were abundant, and the not improbable suggestion has been made that they have contributed to the untimely separation.

Dr. Thomas G. Maghee, of Rawlins, Oregon, sent me, a year and a half ago, a most remarkable calcareous placenta. According to his description, "50 per cent. of the bulk of the placenta was calcareous matter in flakes, scales, and irregular angular concretions. The placenta measured seven inches in diameter and weighed ten ounces; the cord normal. The parents were healthy. The child died three days before labor; it was a well-formed, well-developed female, weighing nine pounds and four ounces."

[1] Hofmeier: Die menschliche Placenta, 1890. [2] Kaltenbach.

Unfortunately, there has been no complete and satisfactory examination of this remarkable specimen; but I hope there will be one made soon.

Myxoma of the Placenta originates in myxomatous degeneration of some of the villi after the placenta is formed. In some cases this degeneration is so general that the fœtus perishes; but in others sufficient of the placenta remains unchanged for the needs of the fœtus, and it is born living at term.

Fibrous Myxoma originates, according to Virchow, in a fibrous degeneration of the mucous substance of individual villi. It appears in the form of thick, compact nodules; according to the extent of their formation will be the effect upon the life of the fœtus: if this extent be great, it perishes.

Inflammation. *White Infarcts of the Placenta.* Inflammation of the maternal portion of the placenta originates in endometritis in pregnancy. It is, according to Hegar and Maier, a process of proliferation of cells, with subsequent contraction, causing atrophy of the villi. The fœtus is imperfectly developed, or abortion occurs. It is asserted that if the inflammation affects the serotina firm adhesions to the uterus may result, requiring artificial detachment of the placenta.

The so-called white infarcts, or fibrinous wedges, are described as "somewhat round or oval, whitish-yellow, hardish parts of varying size, even to several centimetres, that in different numbers are situated most thickly under the amnion." They have been attributed to a coagulation-necrosis caused by periarteritis; by others the starting-point is in changes in the decidua—hyaline degeneration of the decidua and consequent necrosis of the villi. Microscopically they are shown to consist for the most part of coagulated fibrin, in which are included fragments of decidual cells, blood extravasates, and atrophied villi. Their connection with nephritis has been frequently observed, and Kaltenbach mentions his having found the largest placental infarcts more frequently in the placentæ of women suffering with albuminuria than in the case of non-albuminurics.

Small decidual infarcts are common, and have no unfavorable results so long as the villi are not encroached upon.

Syphilitic Placenta. The syphilitic placenta is larger and heavier than the normal placenta; its consistence, too, is often greater. The following are the conclusions given by Zilles in his monograph[1] upon the subject:

1. There is such a disease as placental syphilis, and in many cases it can be diagnosticated by the experienced eye from macroscopic appearances.
2. Placental syphilis is generally, but not always as stated by Fraenkel, associated with fœtal syphilis. The mother may be infected and the child healthy; these are usually cases where she becomes infected during pregnancy.
3. The placenta may be affected throughout its entire thickness, or only either the maternal or fœtal portion. (*a*) When the mother is infected by the fecundating coition, we find, with fœtal syphilis, the placenta more or less affected in all its parts; the cord, too, is usually diseased. (*b*) If the semen alone carry the syphilitic virus, and the mother is not infected, we have fœtal syphilis, and usually only in addition syphilis of the fœtal placenta and of the cord. But it

[1] Studien über Erkrankungen der Placenta und der Nabelschnur bedingt durch Syphilis, von Rudolf Zilles. Tübingen, 1885.

may extend to the maternal placenta, and then the mother is infected. (*c*) In case the mother be infected a short time before conception, the disease not yet constitutional, and the impregnation by a healthy man, if antisyphilitic treatment be employed, a healthy child may be born. In such cases the maternal placenta alone is usually affected. (*d*) If the woman was infected long before conception, usually the maternal placenta only is affected; but the process may extend to the fœtal placenta and to the fœtus. (*e*) When the mother is impregnated by a healthy man and becomes infected during gestation, the maternal placenta is invariably affected, and usually there is immunity for the fœtus.

The placenta cannot be free from disease if the mother be syphilitic, unless the infection occurred shortly before labor.

4. That a woman may be infected by the passage of a syphilitic fœtus through the birth-canal, and *vice versa*, has not been proved.

5. Experience teaches that during the first few years after syphilis has been acquired, and the disease not treated, the children usually die in the uterus, or are non-viable when born. Suitable mercurial treatment may subdue the hereditary power of syphilis or make it latent for a number of years; and this is true, no matter what the stage of the disease. If the disease remain in a latent condition in some of the organs, the effect of treatment may be that for a time healthy children are born, but later syphilitic children.

Tuberculosis of the Placenta. Lehman,[1] of Berlin, has reported a case of tuberculosis of the placenta. The placenta was that of a woman who died from miliary tuberculosis while pregnant; the intestines and peritoneum did not participate in the disease.

Disease of the Chorion. Hydatidiform, or myxomatous degeneration of the chorial villi, has been considered in its partial manifestation, myxomatous degeneration of the placenta, and there is here to be presented the graver variety which, beginning before the placenta is formed, involves all the chorial villi. The disease results in the formation of a mass known as a vesicular mole. This mass is a conglomerate of a vast number of vesicles, varying in size from a hempseed to a cherry, inclosed in thickened decidua; it may be as large as a child's head, and weigh several pounds. After two months the mass is no longer inclosed in the sac, but this sac is torn at different parts and the growths project from the rents.

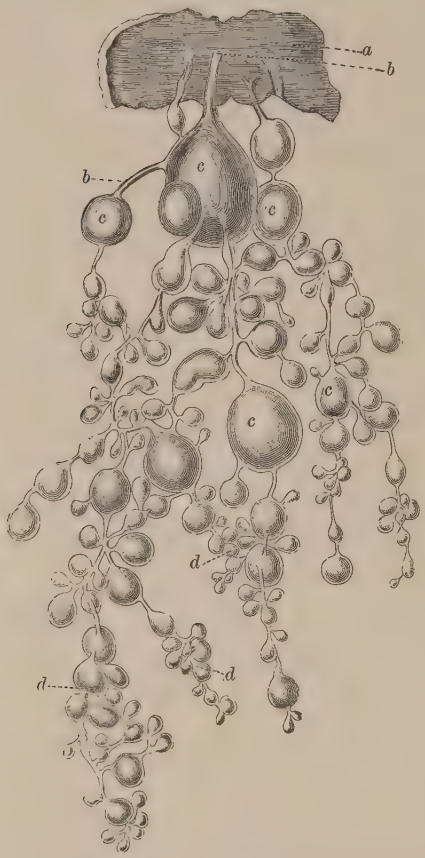
From the opened cyst a watery fluid, containing in addition to albumin mucin, escapes.

In rare cases the entire mass has been expelled inclosed in a sac, the decidua, and this had to be opened to see the peculiar formation. In the centre of the degenerated mass there is usually a cavity found; but if the myxomatous change began early, that is, before the formation of the placenta, and all the chorial villi were affected, the nutrition of the embryo has been so interfered with that death resulted, and it has undergone solution; a little fluid may be found in the cavity, and also, possibly, the remains of a part of the umbilical cord. In some instances the amnial cavity has disappeared, but there is almost always found in such case a soft, yellowish, granular, and spongy tissue occupying its space. The death of the embryo is by most regarded as the consequence, not the cause of the disease. When the disease occurs later, involving only a portion of the placenta, it may not be discovered until after the birth of a well-developed child, and the expulsion of the placenta, which upon examination shows the altered structure.

[1] Centralblatt f. Gynäkol., November 18, 1893.

In rare instances a destructive mole-formation has been observed. In this the degenerated villi perforate the decidua, invade the uterine walls, entering veins, and reach to the serous covering of the uterus; the patients generally perish from hemorrhage or peritonitis, and it is only after death that the true condition has been revealed.

FIG. 177.



BRANCH OF HYDATIGENOUS PLACENTA, AS SEEN BY THE NAKED EYE. (ERCOLANI.)

FIG. 178.

HYDATIDIFORM DEGENERATION OF THE CHORION.

The normal villi of the chorion, as shown by Virchow, have entering into them the same tissue as that which forms the so-called Wharton's jelly of the umbilical cord. Each villus has an external epithelial covering, but the framework, the body of the organ, is formed of mucous issue. Hyperplasia of this tissue is the essential fact in myxomatous degeneration of the chorial villi. With the increase in volume of a villus the more it presents the appearance of mucous tissue. The pedicle of the apparent vesicle is identical with Wharton's jelly. The vessels of the villi are usually obliterated; nevertheless, capillary vessels are sometimes found in the external layers, especially when a part only of the chorion is degenerated, and the fœtus is viable.

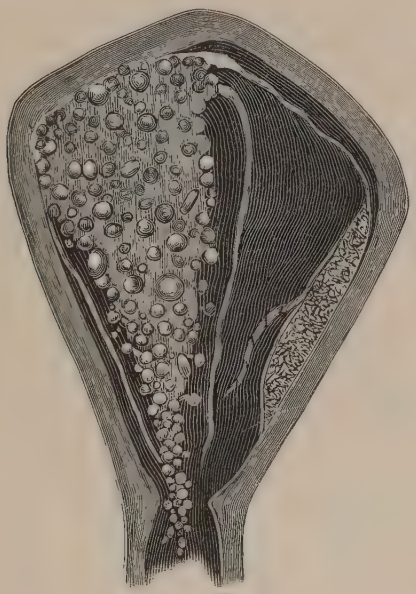
In rare instances there is a double pregnancy, one ovum remaining healthy and the other changed into a vesicular mole. See Fig. 179.

Etiology. This is uncertain. In one case, that of Schröder, there was a large myoma of the uterus; in another there was a tumor of each ovary, and in several renal disease was present with albuminuria, the albumen disappearing after the mole was discharged. Schramm[1] refers to the affection occurring more frequently in pluriparæ who are weak, anæmic, and suffering from cardiac disease.

The disease is not frequent. Madame Boivin saw but one case in 20,375 deliveries.

Two cases in which malignant disease of the uterus followed have been observed by Kaltenbach and Löhlein,[2] originating, it was supposed, from retention of some of the degenerated chorial villi.

Fig. 179.



Twin Pregnancy—Molar and Normal. (Kaltenbach.)

Diagnosis. Depaul mentioned three important signs. 1. A more rapid development of the abdomen than occurs in normal pregnancy. In one of his patients the uterus was four fingers' breadth above the umbilicus at four months. 2. Attacks of uterine hemorrhage. This symptom has occurred as early as the forty-fifth day, and been delayed as late as the fourteenth month. Discharges of blood may, in some cases, alternate with watery discharges. 3. The expulsion of separate vesicles, or of branches of vesicles. Of course, this sign is conclusive. The pregnancy rarely goes to term; yet, in the 32 cases collected by Boivin, in each of three it lasted until 9 months; in three others to 10

[1] Centralblatt f. Gynäkol., 1893, No. 4.

[2] Centralblatt f. Gynäkol., 1893.

months, while one was not delivered until 11 months, and another at 14 months. The danger to the mother is from the exhaustion caused by repeated hemorrhages, or a single sudden and large hemorrhage may prove immediately fatal. The fœtus in almost all cases dies. Yet there are instances in which an "hydatid" mass has been expelled, and the pregnancy continued to term, when a healthy child was born. Such cases were probably instances of a twin pregnancy in which the myxomatous degeneration affected one ovum, the one that was discharged, while the other remained healthy.

Treatment. No active treatment is indicated unless hemorrhage occurs. If this be slight, rest, cold drinks, and an opiate may be sufficient; but if it be severe, the tampon should be at once employed. Even if the fact of myxomatous degeneration be proved by the expulsion of hydatids, it does not follow that the uterus must be at once emptied.[1] The dominant fact which guides the treatment is the hemorrhage. If this persists, if it is grave, and only temporarily restrained by the tampon, then dilate the os uteri, and remove the contents of the uterus with hands or forceps, or dull curette, and secure uterine hæmostasis by exciting uterine contraction mechanically, or by ergot, or by electricity; or, if these fail, use intra-uterine injections of hot water, or apply astringent solutions to the interior of the uterus.

Anomalies of the Cord. Some of these have already been mentioned, such as length of cord, quantity of Wharton's jelly, and false knots.

Coils. One or more loops or "circulars" of the cord about the infant or one or more of its members occurs in many cases; the most frequent are those in which the cord encircles the neck once or oftener; in some cases an upper or lower limb may be caught in a coil. La Motte gives a case in which the cord passed around the neck, then over the chest like a scarf, and under the axilla, and again around the neck. Usually no injurious consequences follow, but in some instances, when the neck is encircled, the loop may become so tight that the circulation in the cord, or in the vessels of the neck, may be interfered with, and the fœtus dies. "If the compression continues after death, the neck may be so thin that it is almost amputated." Amputation of one of the limbs may result from a tight coil of the cord around it, if continued for some time, even though the fœtus be living. Doléris[2] has narrated a case in which the labor was protracted in consequence of the cord forming a double coil about the lower limbs of the fœtus at the ankles; hence the cord was much shortened, and the fœtus, presenting by the vertex, was as it were suspended by the feet.

This case illustrates one of the dangers that arise when the cord is coiled around the fœtus, relative shortness, which of course may cause the same difficulty in labor as absolute shortness does.

It is possible, in some very rare cases, if the abdominal and the uterine walls are thin, to feel the pulsating cord when it encircles the body. Schatz[3] claims that the diagnosis of the cord encircling the neck

[1] All the world knows, remarked Depaul, that the celebrated Beclard was the result of a hydatidiform pregnancy. The possibility of a viable child being born, therefore, is the reason for abstaining from active interference in case of this disease, unless symptoms demand such interference.
[2] Archives de Tocologie, 1882.
[3] Revue Médico-chirurgicale des Maladies des Femmes, 1885.

can be made during pregnancy by auscultation; at first, moderate pressure with the stethoscope is made at the part corresponding with the depression of the neck, and the pulsations of the fœtal heart are normal in frequency; but when strong pressure is made their frequency is lessened to one-half.

KNOTS. In one out of two hundred infants there will be found at birth one or more knots in the umbilical cord. They result from the fœtus passing through a loop of the cord, and according to most authorities may be formed in pregnancy or during labor; Read,[1] however, asserts that they cannot be formed except by the passage of the child through the lower portion of the uterus, for a loop must fall to the vicinity of the os, it cannot remain in any other part of the uterus, and hence they can be formed only during labor; but this view is not gen-

FIG. 180.

KNOT IN THE STAGE OF FORMATION.
P. PLACENTAL END.

FIG. 181.

INTERMEDIATE FORM.

FIG. 182.

AS IT WAS FOUND AT BIRTH.

erally accepted. Admitting the formation of knots in pregnancy, it is exceptional for the vessels to be so constricted as to interfere with the circulation of blood. Depaul has found in one instance five knots in the cord, quite near together, but the fœtus was living and well nourished. On the other hand, Martin Saint-Ange has seen death of the fœtus result from a single knot, and many similar cases have been reported. Great length of the cord predisposes to this accident, and a relatively great size of the uterus facilitates its occurrence in pregnancy.

[1] American Journal of the Medical Sciences, October, 1861.

The knot is sometimes double, as in a case observed by Dr. George H. Lyman, of Boston. Read gives the representations[1] of the successive stages in the formation of the knot in Lyman's case. (See Figs. 180, 181, and 182.)

Excessive Torsion. Twisting of the cord upon its axis generally occurs, according to Spiegelberg, in the second half of pregnancy, especially in the seventh lunar month. He refers to torsions as "præmortal" and "postmortal." The first are caused by the active movements of the fœtus, or by a severe fall received by the mother. Winckel suggests that the movements of one of the two fœtuses contained in a single amnion may cause twisting of the cord of the other. The "postmortal" torsions are caused by the movements of the mother. Dancing is mentioned by Kormann as a cause of torsions of the cord. They occur more frequently in male than in female fœtuses, the proportion being 13 to 9. Excessive movements of the fœtus, causing torsions of the cord, were attributed by Billi (quoted by Hecker) to disease of the brain. The facility of active and of passive movements, too, in the fœtus of the multigravida being greater than in the primigravida, these torsions are more frequent in the former. It is said that a division of the cord may be caused in a short, tense cord by twisting, it being thus separated from the fœtus, so that the latter is unattached in the uterine cavity. The torsions are most numerous in the vicinity of the umbilicus, and next at the attachment of the cord to the placenta. Torsions of the cord may cause occlusion of its vessels, or only stenosis. Death of the fœtus follows occlusion or great stenosis. In some instances fine thrombi are found in the vessels; these indicate that the torsions occurred suddenly. Fritsch has observed that in some cases torsions occur in successive pregnancies.

I have seen a case in which there were forty-six twists in the cord; the fœtus had died in the seventh month, and was macerated. A remarkable illustration of very numerous twists of the cord is shown in Fig. 83.

Narrowing of the vessels may occur independently of torsions. These stenoses are usually found in the vein near its placental end; "they were first observed by Oedmanson and Winckel, and their anatomical description given by Birch-Hirschfeld." They have been described as sharply defined proliferations of the *intima*, partly of fusiform, partly of round cells, and forming a fibrillated tissue, as a granular matrix with oval and globular nuclei. Beginning in the *intima*, the *adventitia* becomes affected ultimately, and shows an accumulation of lymphoid elements. Birch-Hirschfeld found circumscribed stenoses involving the *intima* of the arteries in the vicinity of the navel and of the placenta; he regards them as resulting from syphilis, stating that the microscopical examination agrees in every particular with those changes which Heubner described as syphilis of the vessels of the brain. According to Spaeth, atheromatous changes may occur in the arteries. Stenosis may be the consequence of periphlebitis, according to Hyrtl. Cysts found in the cord are remnants of the urachus lined with epithelium.

Martin Saint-Ange[2] narrates a case of a dead fœtus being expelled at seven months, the death caused by complete strangulation of the cord lying between the legs, which crossed each other and were firmly applied together by a convulsive condition.

[1] Charpentier in using these illustrations has substituted Leyman for Lyman.
[2] Op. cit.

Anomalies of the Amnion and of the Amnial Liquor. The question as to inflammation of the amnion, *amniotitis*, is undecided. The formation of amniotic bands, resulting in amputation of fœtal members, or in the production of fœtal malformations and adhesions between the amnion and different parts of the fœtal surface, seems to indicate that inflammation of this membrane does occur. According to some, acute polyhydramnios is the consequence of inflammation of the fœtal membranes; this was the theory taught by Mercier more than fifty years ago.

The narrow space which the fœtus occupies prevents its proper development. Certain deformities, such as *talipes valgus* and *t. varus*, occur more frequently in connection with scanty amnial liquor—so, too, some forms of single monstrosity, as symmelian and syrenian.

Dareste[1] has shown the important connection between certain fœtal anomalies and the condition of the amnion. The formation of amnial bands may result from oligohydramnios—that is, deficiency of the amnial liquor—as follows: The amnion is in contact with parts of the fœtus, not kept separate by fluid, and adhesions result; but with increase of fluid these adhesions are stretched, and thus cords or bands are formed. Another result of deficiency of amnial liquor is superficial adhesions between the members of the body.[2]

Polyhydramnios. The most frequent anomaly relating to the amnion and its liquor is that which consists in an excessive production of amnial fluid, incorrectly designated as hydramnios or hydramnion, for neither of these words means excess of this fluid. Polyhydramnios exists whenever the quantity of amnial liquor exceeds two and one-half pints. Baudelocque stated that the excess might reach to sixteen litres, or even to twenty-five, about thirty-three to fifty-two pints.

The affection occurs oftener in the multigravidæ than in primigravidæ—according to McClintock, 23 to 5; it is more frequent in twin than in single pregnancies, and in the former case the children are oftener of the female sex. The production of monstrosities occurs more frequently in polyhydramnios. Syphilitic disease of the mother has been observed in many cases of polyhydramnios. In some cases—Depaul has reported one—the affection occurred in an ectopic pregnancy. In twin pregnancy polyhydramnios may be present in one ovum, with oligohydramnios in the other.

Etiology. Polyhydramnios has been attributed to various causes. According to Jungbluth, the *vasa propria*, which usually become obliterated in the last months of pregnancy, remain open, and hence the disease. The open condition of these capillaries is favored by obstruction to the fœtal circulation, as from congenital defects of the heart (Lebedjew), and diseases of the liver (Küstner). Support[3] is given the hypothesis by the greater frequency of malformations and death of the fœtus, and a large and œdematous placenta with polyhydramnios. It has been attributed to excessive activity of the renal function. It has also been thought to result from disturbances in the mother's circulation, as shown by great œdema or by dropsy. In some cases the decidua is greatly

[1] Archiv de Tocologie, 1883. [2] Kormann. [3] Kleinwächter.

hypertrophied, and the chorial villi are swollen. Gervis[1] attributes the affection to inflammation of the amnion, to a diseased condition of the decidua, and to dyscrasia of the maternal blood.

In two of several cases of diabetes mellitus in pregnancy,[2] collected by Dr. Matthews Duncan, there was excess of amnial liquor; one of the two occurred in his own practice and the other in that of Dr. W. L. Reid, of Glasgow.

Forms of the Disease. Polyhydramnios occurs in two forms, chronic and acute. The former is the more frequent, and does not usually appear before five or six months of pregnancy. It is characterized by a more rapid increase in the size of the abdomen than occurs in normal pregnancy, the fœtal movements are not readily felt by the mother, nor can the sounds of the fœtal heart always be distinctly heard by the obstetrician; the uterus has a more spheroidal than ovoidal form, the respiration is interfered with, and the patient may be unable to lie down. It is difficult or impossible to recognize the fœtus by palpation, and fluctuation is very well marked. By vaginal examination the lower segment of the uterus is found drawn up into the abdominal cavity, and the neck of the uterus is more or less effaced.

The acute form, which may suddenly appear in a case in which the accumulation has hitherto been proceeding gradually, or may be primitive, is characterized by symptoms similar to those mentioned. But the discomfort is greater, for when the collection is gradual the system is more tolerant; but, beside, there is often fever, and also there are nausea and vomiting in the acute form.

It is more frequently observed in case of twins.

Dr. John S. Miller, of Philadelphia, has given me the notes of a case of polyhydramnios which I saw in consultation with him: "Mrs. E, thirty-five years of age, had previously given birth to six healthy children. At four months in her seventh pregnancy was larger than in any previous pregnancy at term. No fever, but persistent vomiting after fourth month. Circumference at umbilicus, fifty-three inches. Miscarried at six months with male twins; one large, well developed, and lived for a few minutes after birth; the other small, flattened, only about six inches long; the excessive quantity of fluid came from the sac occupied by the larger fœtus. The quantity actually measured was thirty-one pints, but a considerable amount escaped in the bed."

Bar[3] maintains that as great pressure affecting the portal vein causes ascites in the adult, so increased pressure in the umbilical vein produces excess of amnial liquor. Mantel[4] asserts, from a very thorough study of the subject, that there is an undeniable frequent coincidence between the insertion of the placenta at the lower part of the uterus and polyhydramnios, and explains the latter as resulting from the former in consequence of the pressure which the placenta thence undergoes, and the modifications of circulation in the cord; an obstacle to the normal course of the blood is presented, and hence blood-stasis and a considerable osmosis into the amnial cavity.

Polyhydramnios occurs probably once in 150 labors. The acute

[1] St. Thomas's Hospital Reports.
[2] Transactions of the London Obstetrical Society, vol. xxiv.
[3] Journ. de Méd. de Paris, January, 1889.
[4] Arch. de Tocol., 1888.

form is very rare. The prognosis for the fœtus is unfavorable; in McClintock's cases, out of 33 children 9 were stillborn and 10 died within a few hours after birth; 25 of the 33 children were females.

Spiegelberg has remarked that he knew "a number of instances in which the hydramniotic uterus was mistaken for a simple ovarian cyst, and tapped; this has happened once in my own maternity. Greater care in making the diagnosis will prevent making such mistakes." Nevertheless, Winckel states that a definite diagnosis in some cases is impossible, and it might be advisable then to resort to exploratory abdominal section. This was done by Wilson,[1] of Baltimore.

Errors in diagnosis are to be avoided, first, by establishing the fact of pregnancy by subjective and objective signs; among the latter, Braxton Hicks's will in some cases be of great value; second, by recognizing the enlargement as being in contact with the abdominal wall in the median line; third, by finding the lower segment of the uterus very high, and more or less complete effacement of the cervix; fourth, by carefully studying the history of the enlargement as to position, as to progress, and as to symptoms produced. Runge advises in doubtful cases examination during anæsthesia.

Treatment. This is palliative and expectant, unless grave symptoms arise from the excessive distention; when these occur the pregnancy should be ended. It has been advised to puncture the membranes high up, and to use the hand as a tampon to check the rapid discharge of the amnial fluid. Of course, if a transverse presentation occurs, turning must be resorted to, otherwise it is better to leave the labor to nature; it should be remembered that atony of the uterus may result from its very great distention, and hence there is a liability to post-partum hemorrhage, which should be carefully guarded against.

In some cases puncture of the uterus through the abdomen has been employed to relieve the excessive distention. Even if premature labor or abortion result, this could hardly be regarded as an evil. But in two cases, one reported by Tillaux and the other by Lepage, the pregnancy did not end until a month after the operation.[2] In a case mentioned by Brouardel the condition was mistaken for an ovarian cyst, puncture followed by free evacuation of the amnial liquor was done, and the pregnancy continued three months. Schatz recommended puncturing the uterus from time to time with a fine trocar, drawing off a portion of the fluid, so that premature interruption of pregnancy may be prevented.

The Pathology of the Fœtus. The pathology of fœtal life includes malformations, usually arising from arrests of development, teratogeny, or the formation of monstrosities, constitutional and local diseases, injuries, and death. So far as any of these cause difficulties in delivery, they will be considered in connection with the pathology of labor.

Vices of conformation are, as previously stated, usually arrests of development. Thus there may be harelip, or spina bifida, and the origin of each has been presented. An imperforate anus or vagina was normal at a certain period of evolution, and only its permanence

[1] American Journal of Obstetrics, 1887.
[2] Revue Médico-chirurgicale des Maladies des Femmes, December, 1889.

renders its pathological; so, too, in regard to duplicity of the vagina and of the uterus. In some instances there may be defective formation of one or more members, and hence one kind of monstrosity known as ectromelic;[1] in the gravest form the monstrosity is without members—that is, an amelic.[2] Occasionally there may be excess of members, superfluous development; thus there may be six fingers on each hand, an anomaly so common among the Romans that they gave the name of *Sexdigiti*[3] to persons having six fingers. In many cases the anomaly has been found hereditary.

Acute Infectious Diseases. The fact that the fœtus may suffer from variola has been established in numerous instances. So, too, there have been a few cases reported of children born with the eruption of rubeola. Thomas stated in 1874 that there were only 6 cases of certain transmission of the disease to the fœtus; but 3 have been reported since, one of them being by Lomer.[4] In more frequent cases the child has been attacked with measles shortly after birth, but so soon that the intra-uterine transmission of the disease cannot be questioned. The proof that the poison of scarlatina may affect the fœtus rests upon a few cases. It cannot be doubted that the child while in the uterus may suffer from malarial fever, and the observations of Dr. Bemiss, previously given, render it probable that it may also have yellow fever.

Hirst[5] quotes an instance in which the specific bacilli of typhoid fever were found in the fœtus, the mother having had the disease. A similar fact has been reported by Eberth.[6] Vinay, accepting the transmission of the typhoid bacillus to the fœtus, suggests that if the latter is dead at birth it has been killed by the typhoid germ or by the toxines it secretes. Recognizing pneumonia as an acute infectious malady, it was thought[7] probable that pneumococci might pass from a mother suffering with the disease to her fœtus, and such transmitted affection was in some cases the cause of fœtal death; the intra-uterine transmission of pneumonia is now admitted. Instances showing the probable infection of the fœtus with erysipelas from the mother have been published.

Chronic Infectious Diseases. A few instances of congenital tuberculosis have been observed. (See page 422.)

Fœtal syphilis is very frequent. The changes caused in the fœtus by syphilis "are found in its skin, thymus, lungs, liver, spleen, suprarenals, pancreas and intestine, on its serous membranes and in its bones; they are most constant in the latter and in the spleen." In the spleen no pathological products have been found, but the organ is greatly enlarged. An osteo-chondritis is the special manifestation of syphilis, and is found in the tubular bones, the lowest end of the femur usually showing the most striking changes. The disease "begins with an excessive proliferation of the cells at the margin of the epiphysis, which is rapidly followed by an irregular calcareous infiltration and sclerosis

[1] From Ἔκτρωσις, abortion, and μέλος, a member. [2] From ἀ privative, and μέλος.
[3] Probably the first historical reference to a person having supernumerary fingers and toes is in the Bible, 2 Samuel, chap. xxi., ver. 20.
[4] Centralblatt f. Gynäkol., 1889.
[5] American System of Obstetrics, vol. i. [6] Arch. de Tocologie, 1889.
[7] De la Pneumonie pendant la Grossesse, Annales de Gynécol., 1889.

of the newly formed tissue." If the child is born living, it is usually feeble, under-sized, its skin presenting syphilitic eruptions, pemphigus and impetigo, and there are buccal and genital mucous patches. Its cry is weak, and it suffers from obstinate coryza.

Rhachitis. Intra-uterine rickets produces similar deformities to those caused by the disease occurring after birth. Fractures of bones are not uncommon, and the limbs are not developed in proportion to the trunk, but are short.

Spontaneous Amputations. These may concern the upper or the lower limbs, more frequently, however, the latter; they are caused either by amniotic bands or by the cord encircling the member that becomes mutilated, producing a constriction which prevents the part below the constricted place receiving any blood; if the bone be cartilaginous, there is no improbability in the statement that complete section

Fig. 183.

Spontaneous Intra-uterine Amputation.

may occur, but in some cases at least of spontaneous amputation the final separation of the member, after constriction of the soft parts, has resulted from a fracture. Cases of amputation cannot be confounded with those where there has been deficient development, for the amputated member has been expelled with the fœtus from the uterus. Generally those fœtuses to whom this accident has happened are stillborn.

Spontaneous and Accidental Fractures. Chaussier saw one fœtus with 43 fractures in different parts of the skeleton, and another with 113. The late Dr. Hodgen, of St. Louis, reported the case of a child which at birth had 65 fractures; he attributed them to muscular action during intra-uterine life.[1] Branfoot[2] reports delivering a fœtus with the femurs and both bones of each leg fractured. Fractures may be caused by external violence to the mother. Packard[3] gives cases in which the broken bones were firmly united at birth, but others in which there was no union. Brinton has reported two cases of intra-uterine fracture, one of the tibia, the other of the clavicle, occurring from injuries received by the mothers.[4]

Luxations. Dislocations of bones, more especially of the femurs,

[1] St. Louis Medical and Surgical Journal, 1882.
[2] British Medical Journal, 1888.
[3] International Encyclopædia of Surgery, vol. iv.
[4] Transactions of the American Surgical Association, vol. ii.

occurring in the fœtus are not absolutely rare, though their etiology is obscure. They are observed more frequently in females than in males. In some instances they may be the result of external violence, but in most no such cause can be adduced; and, therefore, they are attributed to "anomalous development of articular cavities."

Tumors. In addition to the tumors caused by spina bifida, omphalocele, meningocele, or encephalocele, various other tumors, fluid or solid, may be found upon different parts of the body. Some of these are pedunculated; others attached by a broad base; sometimes they are so large as to render parturition difficult or impossible without operative means.

Death of the Fœtus. The fœtus having perished from disease or injury, whether affecting it directly or mediately, we have next to study the diagnosis and the consequences of its death.

Diagnosis of the Death of the Fœtus. The previous recognition of the fœtus being alive facilitates the inquiry as to its being dead; by the continued absence of those signs which gave conclusive proof of its life, we have a strong probability of its death; this absence must be ascertained by a most careful examination—indeed, it is safer to repeat the examination once or oftener. The death may have occurred prior to the time that positive proofs of life were available, or they may not have been ascertained. We inquire as to whether any injurious influences, paternal, maternal, or directly acting upon the fœtus, the common result of which is death, have been present. Thus, the father or the mother may be affected with syphilis, the mother may have had an acute infectious disease, or received some severe injury. The absence of fœtal movements, which the mother had certainly recognized; the deterioration of her health; the breasts, after having been full, and possibly secreting milk, becoming flaccid;[1] she is pale or sallow, has occasional chilly sensations, the abdominal wall somewhat relaxed, and she may complain of what seems a dull weight in the abdomen, falling from one to the other side, in correspondence with changes of position in bed. The temperature of the uterus, being greater than that of the vagina in pregnancy, will now show no such change; but this examination is rarely made. There is one sign constantly available which, I believe, is a positive proof of the death of the fœtus, and that is, if, with the negative evidence furnished by auscultation and palpation, there is found regular diminution in the size of the abdomen, the woman not suffering from any disease explaining this change, we are justified in concluding that the child is dead.

There may be conjoined with examination by measurement of the abdominal circumference, weighing the patient from week to week; if the child be dead she will probably lose in weight, whereas if it be alive there will be a constant gain.

Consequences of the Death of the Fœtus or Embryo. These are remote or immediate. The only remote consequence is the expulsion of the uterine contents, and this will be first considered—very briefly, however, because the subject must be presented elsewhere. The expul-

[1] One of the aphorisms of Hippocrates is that, if the mammæ of a pregnant woman suddenly begin to lessen in size, she will abort.

sion usually takes place within two weeks, and if delayed beyond that time the name given is missed abortion. There may be delay for a few weeks, or even for several months. In the case of one of twins dying during pregnancy it is not unusual for it to be retained until the normal end of pregnancy, and then it is expelled along with the living child. Such cases, improperly interpreted, have furnished an argument for superfœtation. So, too, in a single pregnancy, a three-months' fœtus, for example, may be expelled at the end of nine months' gestation, and this ought to be borne in mind by the practitioner, lest a wife, her husband having been absent for some months before such expulsion, may suffer unjust suspicion or reproach.

The Immediate Consequences of Death of the Product of Conception. Certain changes follow this event; they are *liquefaction*, *mummification*, *maceration*, and *putrefaction*.

1. *Liquefaction.* This may occur during the first two months at least, the embryo being dissolved so completely that no trace, or only a trace, of it is left. The amnial liquor becomes thick and opaque, sometimes having a milk-like appearance like an emulsion. Important changes meanwhile occur in the fœtal appendages. If myxomatous degeneration of the chorial villi has already begun, it continues. But more frequently the formation of what has been termed a fleshy mole[1] follows. This is composed of the deciduous membranes, and the membranes of the ovum, with a central cavity occupied as mentioned, of the placenta in process of formation, and of blood which is infiltrated between the chorial villi and between the membranes. The separation between the mass and the uterus being incomplete, the former is nourished, and growth of its elements continues, the clots are absorbed, or the fibrin, according to Scanzoni, becomes organized, the amnial cavity grows smaller, and finally a nearly solid mass results. The "fleshy mole" may be retained in the uterus for some weeks, giving rise meantime to occasional attacks of uterine "pains" and hemorrhage.

In 1892 I published[2] a brief study of fifty-four cases of molar pregnancy. Only four occurred in primigravidæ, and the mean duration of the pregnancy was three to four months. In that paper I attributed chief importance to disease of the chorial villi, as indicated by microscopic examination. But the fact of almost all the cases occurring in multigravidæ leads me now to the conclusion that usually the primary factor is disease of the deciduæ.

2. *Mummification.* This has been compared to the change which a fruit undergoes when kept in alcohol. The soft tissues of the fœtus become condensed, contracted, hardened, dried up, and thus it is less-

[1] Depaul has remarked that (Dictionnaire Encyclopédique des Sciences Médicales, second series, vol. ix.) "nothing is yet more obscure to-day than the etymology of the word mole. The most natural is that which derives it from the Latin word *moles*, which signifies mass." I think that Depaul was mistaken. It seems that both Hippocrates and Aristotle applied the word Μύλη, which originally meant a mill, to "a hard formation in a woman's womb." From this word the Romans had *mola*, also primarily meaning a mill; Pliny certainly applied *mola* to such an intra-uterine formation as has been mentioned. But both μέλη and *mola* mean secondarily the stone which was essential for grinding. Hippocrates undoubtedly had observed calcified fibroids discharged from the uterus, and it was quite natural that such a formation should be called μύλη. The application of the term to other solid masses expelled from the uterus would obviously follow. And, therefore, the derivation of the term mole from *moles* is unnecessary, for it seems properly to originate from the Greek μύλη, the Latin *mola*.

[2] American Journal of the Medical Sciences, October.

ened in size and presents a shrivelled appearance; its color becomes a dull gray or yellow. The amnial liquor finally disappears, leaving as a residue an earthy, grayish sediment "similar to the deposit left by a stream after an overflow of its banks." Mummification, of course, does not occur if the membranes have been ruptured, nor is it usually seen except in a fœtus of three to four months.

3. *Maceration.* The macerated fœtus is larger than corresponds with the period of intra-uterine life at which it perished; it is swollen, its form changed, the abdominal cavity is often greatly distended; its tissues are softened, the bones lose their firm attachment, and especially those of the cranium move freely upon pressure; the skin presents numerous blebs, and the epidermis comes off in large flakes, showing the derm beneath of a dusky red; the serous cavities contain blood-stained serum, and the blood escaped from its vessels contributes its coloring-matter to dyeing the tissues; it is sometimes known as *fœtus sanguinolentus.* Runge states that in 70 to 80 per cent. of cases the macerated fœtus presents evidences of syphilis.

Ribemont-Dessaignes,[1] after referring to the generally admitted view that the external signs of maceration—the formation of blebs and the detachment of the epidermis—are not manifested until the third day after the death of the fœtus, holds that these lesions may appear much earlier, a few hours after death, and even upon the living fœtus, and adduces cases in illustration.

4 *Putrefaction.* This occurs when the membranes have been ruptured, and thus air gets access; air with moisture and warmth furnishes the essential conditions for putrefactive changes. Putrefaction occurs very rapidly, and McClintock[2] stated that he had seen the uterus become quite tympanitic from this cause after the accession of labor and before delivery. The abdomen of the fœtus is distended by gas, the connective tissue emphysematous, crepitating upon pressure, the entire body and members greatly swelled, so that serious difficulty in delivery may be presented, and a horrible odor exhales from the fœtus. In some cases gas accumulates in the uterus, a condition known as physometra, and the organ is greatly distended and tympanitic. Generally the effect of fœtal putrefaction upon the mother is more or less grave; she has chills, fever, diarrhœa, and death may result from the infection of her system, unless the decomposing fœtus be promptly removed, and appropriate local antisepsis be employed.

Abortion. Abortion is the expulsion of the product of conception before the fœtus is viable. Miscarriage is commonly used as a synonym, though by some it is restricted to an abortion occurring after three months;[3] the reason for this distinction is that the treatment of the accident varies at these different periods. But such distinction is purely arbitrary. Further, abortion has been divided into ovular, embryonic, and fœtal; the first is applied to an abortion in the first three weeks, the second to that which happens between the end of the three weeks and of the first three months, and fœtal is used to designate the accident from the end of three to that of six months.

[1] Annales de Gynécologie, July, 1889.
[2] Note to Sydenham's Society's edition of Smellie's Midwifery.
[3] Miscarriage in this restricted sense is also called *partus immaturus.*

CLASSIFICATION. Abortion has been divided into spontaneous, or natural, and accidental; by the former a miscarriage occurring from obscure or latent causes is designated, and by the latter one that has an obvious cause. But this distinction is in many cases impossible to be made. A better division is into spontaneous and artificial. The latter class is divided into therapeutic and criminal; therapeutic abortion is that which is done by the physician in the interest of the mother's life or health, while criminal abortion is without this or any other justification. The term incomplete, or imperfect, is applied to abortions in which the entire ovum is not expelled. Missed abortion has been previously defined.

FREQUENCY. There are, and there can be, no data by which the absolute or relative frequency of abortion can be ascertained, for many cases occur without the subjects knowing it, and many other abortions are self-produced, or performed by professional abortionists, and, therefore, kept secret; in only exceptional instances when a fatal result follows do medical men or the public know of them. Whitehead's statistics[1] show that 87 per cent. of women living in wedlock until after the menopause had aborted at some time in their married life. Priestley[2] estimates the number of abortions as one to four labors; Ahlfeld, one in five. But even the former proportion, though greater than given by most writers, is probably too small. The sterility of prostitutes as well as that of many newly married women may frequently be attributed to early abortion.

TIME OF ABORTION. The greater number of miscarriages occur in the first three months of pregnancy. There is an exception to this rule, however, given by those cases of criminal abortion which become subjects of judicial inquiry. Tardieu[3] has shown by statistics collected by himself and others that criminal abortion is more frequent from the third to the sixth month than in the first two months. The explanation of this fact is, that up to three months a woman hopes there is simply a delay in the appearance of the flow, but when this hope fails she is ready to resort to active means to end a pregnancy which has now become almost certain; on the other hand, when six months have elapsed the life of the child has become so manifest that she shrinks from its destruction—fœtal movements make successful appeal to the mother's conscience, if not to her love also, for the salvation of the new life which dwells within her womb as its sanctuary. The great majority of spontaneous abortions occur at a time corresponding with a monthly flow; Boerhaave made the proportion nine out of ten.

CAUSES OF ABORTION. Very trifling causes may produce miscarriage in some women. La Motte has said that a misstep, raising the arms too high, a strong odor, as of musk, amber, or civet; a bad odor, as from a dead animal in the road, from a charcoal fire just kindled, or from a lamp or candle imperfectly extinguished, may end the pregnancy in some. On the other hand, the most active exercise, the severest injuries, grave surgical operations, the most cruel violence, or the use of enormous doses of irritant medicines reputed abortive, have not caused miscarriage in others.

[1] Abortion and Sterility. [2] Op. cit. [3] Etude Médico-légale sur l'Avortement.

Instances of frequently recurring abortion are not uncommon; one has been mentioned of a woman who miscarried twenty-four times at three months. These have been termed habitual abortion. But, as remarked by Kleinwächter, habit is not to be regarded as a cause; it would be more rational, since habit did not begin the series, to attribute the abortion, in most cases, to the still acting original cause. Dr. Meigs ascribed so-called habitual abortions to excessive irritability of the uterus; others have held that they were caused by a want of nutritive material in the uterus for its complete development, the organ growing for a time, and then the growth ceases and abortion follows. Neither hypothesis rests upon established facts, but each indicates the incorrectness of the view that habit is its cause.

The causes of miscarriage do not, in all cases, act separately, but very frequently two or more are combined. Some simply predispose to the accident, while others are the efficient agents. In their further consideration, it is convenient to divide them into paternal, maternal, and those belonging to the ovum.

Paternal Causes. According to Deviliers, the procreative power being distinct from that of development, the evolution of the product of conception is almost entirely under the influence of the degree of vitality of the mother. Nevertheless, the father being syphilitic, the fœtus may be infected and perish, though the mother remains healthy. It is quite possible, too, that in addition to syphilis other diseased conditions of the father, such as alcoholism and phthisis, may result in a fœtal malady which is incompatible with the continuance of pregnancy. The injurious influence of lead-poisoning acting through the mother upon the fœtus has been shown by Constantin Paul,[1] Roque,[2] and Rennert.[3] But Lefour[4] has also taught that if the father be a worker in lead, the mother not being exposed to lead-poisoning, there is great liability to abortion.

Maternal Causes. These may be divided into external and internal, or those coming from without and those acting from within. Among external causes are violent exercise, as running, dancing, jumping, riding on a hard trotting horse or over a rough road; lifting heavy weights, falls, blows[5] upon the abdomen, compression of the body by clothing or by corsets, compression of a varicose limb, the use of the uterine sound, applications to the cervix, leeching the cervix or the vulva, and surgical operations, especially if involving the genital zone. Frequency of coition is not unseldom a cause of miscarriage. Whitehead[6] has stated that there can be little doubt that a great number of cases of uterine disease, attended with vaginal discharge, and frequently resulting in abortion, may be attributed to intemperate sexual intercourse

[1] Arch. Gén. de Médecine, 1860.
[2] Paris Thesis, 1873.
[3] Arch. für Gynäkol., 1881.
[4] Gaz. hebd. des Sci. Méd. de Bordeaux, 1887.
[5] History gives us two noted instances of husbands causing abortion by kicking their wives. One of these was Cambyses, the son of Cyrus: he is referred to in "Ezra" as Ahasuerus. He subjugated Egypt more than 500 years before the Christian era; while living in that country, according to Herodotus, he married his sister, and one day, becoming enraged at her just rebuke of some of his many evil acts, kicked her, she being pregnant at the time, and death, preceded by miscarriage, resulted.

In Fleury's Histoire Ecclesiastique, Paris, 1722, it is stated that one of the crimes of Novatus, an heresiarch of the Carthage Church about the year 258 A.D., was kicking his pregnant wife, causing miscarriage.
[6] Op. cit.

during pregnancy. Depaul held that two-thirds of spontaneous abortions were caused by coition, while Miquel, of Tours, makes the proportion still greater—nine out of ten.

Great altitudes are said to be a cause, and it is asserted that in certain mountainous countries pregnant women descend to the valleys to escape the accident. Hot climates are thought by some to cause it. This effect has also been attributed to hot baths. The opinion is confirmed by the statement of Kormann[1] that when used to excess they are apt to produce a miscarriage.

Among internal causes are acute infectious diseases. Chronic infectious diseases differ in their influence upon pregnancy, phthisis comparatively seldom arresting it, while syphilis frequently does. Olshausen regards syphilis and retroflexion of the uterus as the most frequent causes of spontaneous abortion. Cardiac disease may cause abortion. Lyden[2] states that cardiopathics frequently miscarry, and this is the means taken by nature to avoid accidents. Some of the sporadic diseases produce the same result, as has been previously mentioned; so may lead-poisoning and albuminous nephritis. It is by some held that a pregnant woman working in a tobacco factory is thereby rendered liable to miscarriage.[3] Abortion may result from violent sneezing, coughing, or vomiting; likewise from diarrhœa or dysentery. Adhesions of the uterus from former peritoneal inflammation may prevent the development of the organ, and thus end the pregnancy; so, too, rigidity of its body, or relaxation of the cervix, are regarded as causes. Abdominal tumors external to the uterus may occupy so much space that there is no room for the pregnant uterus, and hence its contractions resulting in expulsion of the ovum may be evoked. Positional and structural diseases of the uterus are causes. Among the former prolapse and posterior displacements are of especial significance; among the latter malignant diseases, particularly of the fundus, polypi and fibroid tumors; a lacerated cervix may cause repeated abortion. Strong mental emotions, as fear, sorrow, joy, or anger, are occasionally causes. Whitehead and Duncan, among others, have mentioned the fact that the last pregnancy in the childbearing period is quite liable to end in a miscarriage.

Abortion from the Use of Medicines. It sometimes happens that abortion is caused by the use of drugs, as, for example, active cathartics, or even laxatives or emetics. It may be that in some cases the administration of quinine has been followed by miscarriage, and while in almost all instances the event is justly attributed to the disease for which the medicine is given, yet possibly the latter, in a few, was, from some peculiarity of constitution of the individual, the efficient agent. Nevertheless, neither this nor any other drug can be regarded as an abortifacient; there must be some tendency to miscarriage, some abnormal condition which renders those who thus suffer after taking any of these agents liable to miscarry. I have known two pregnant married women take an infusion of May-apple in such large quantity

[1] Op. cit.

[2] Berlin. klin. Wochenschrift, 1893.

[3] The testimony of medical men who have investigated this subject differs, but I think the weight of authority is in favor of the statement made in the text. See article by Dr. Pradel, Journ. de Méd. de Paris, August 5, 1888.

as to produce violent catharsis and emesis with great prostration, yet in neither was the pregnancy interrupted.

Causes belonging to the Ovum. Velpeau, after examining the ova from two hundred abortions occurring under three months, found one-half were diseased. The various diseases of the decidua that have been mentioned, and its premature atrophy, are frequent causes; also placental apoplexy and the different degenerations of the placenta. Polyhydramnios in most instances causes the pregnancy to be arrested, in consequence of the great distention of the womb. The uterus, too, in many cases reacts prematurely in consequence of similar excessive distention in plural pregnancy. Abnormal site of the placenta may cause miscarriage. The fœtus may be affected by the same disease as the mother, or suffer independently of her, and its death result in abortion. Disease of the umbilical cord, or its compression, may have a like fatal effect upon it, and thus upon the pregnancy.

Symptoms. In some cases of abortion premonitory symptoms may be observed. These are alternate flushes of heat and chilliness, a feeling of languor or feebleness, lumbar pain, a sensation of pelvic weight, of fulness of the lower part of the abdomen, some irritability of the bladder, and possibly of the rectum also.

The characteristic symptoms are hemorrhage and painful contractions; contractions are, indeed, the efficient cause of abortion. In the first weeks abortion may be readily mistaken by the woman herself, especially if she has had other early miscarriages, and by the physician for an attack of dysmenorrhœa. But the rule is, that in the latter pain precedes the flow of blood, whereas, in the former, the phenomena occur in the reverse order, or else they are simultaneous. Some cases have early in their progress a gush of watery fluid slightly discolored with blood; this discharge does not necessarily indicate rupture of the ovum, and hence that miscarriage is inevitable, for it may occur from catarrhal endometritis. But no such discharge occurs either before or during menstruation. Usually the flow of blood is very much greater than that which occurs in menstruation. Further, it is possible some of the reflex disturbances arising from pregnancy may have appeared; and if so, this fact will assist in making a diagnosis. The final proof of the case being one of abortion and not of difficult menstruation would be finding the ovum in the discharge, possibly surrounded by a clot of blood. The ovum of an early abortion is generally entire, though the fact that the sac is ruptured is not a proof, as claimed by some, that the miscarriage has resulted from criminal means. In some cases occurring from the first to the second month, blood may not only be effused between the decidua and the chorion, but also penetrate the chorion and then the amnion, more or less completely filling the amnial cavity.

If the pregnancy has advanced to seven or eight weeks, or further, but still not reached three months, the symptoms of abortion are usually quite plain. The suffering, the regular recurrence of the pains, and the marked hemorrhage, scarcely leave room for doubt. It is a labor in miniature, at least so far as it relates to the expelling organ and to the expelled product, but not in miniature in regard to the duration of the process and the attendant suffering. The ovum is in the majority of

cases expelled entire if there has been no improper interference. The chorial villi are very distinct, and, as Pajot has said, the entire external surface of the ovum is placenta. The deciduous membranes are usually discharged afterward—at least a considerable portion of these does not pass off with the ovum.

If the pregnancy has advanced to three months or beyond—that is, if the abortion be fœtal—the ovum is usually ruptured in the process, and the fœtus is expelled first and its appendages afterward; in this respect the course is similar to that of labor. A delay of many hours, or even of several days, may occur in the expulsion of the fœtal appendages; and during this retention the patient is liable to attacks of hemorrhage, or she may have a bloody and purulent offensive discharge.

It happens in some cases that after severe pains, and more or less hemorrhage with dilatation, so that the finger can touch the ovum, even, too, with discharge of a fragment of decidua, as has been observed by Spiegelberg, Matthews Duncan, and others, the symptoms of miscarriage gradually cease, and the pregnancy is completed. More frequently, however, the cessation is temporary; it may last some hours, or even days, and then uterine action is renewed, and the usual result follows. In those cases of threatened abortion in the early months in which the symptoms permanently cease, though there has been considerable hemorrhage, the discharge came from detachment of the ovum at its lower segment; such cases are usually seen before the placenta is completely formed.

In the fourth month, and on to the seventh, the course of abortion is similar to that of premature or of mature labor, the process being, however, longer than in labor, because the cervical changes which precede the latter must be effected, and because the uterine muscular structure is imperfectly developed. Hemorrhage is less to be feared as the seventh month is approached; the uterine decidua is more readily cast off in late than in early abortions. Before the formation of the placenta the hemorrhage comes from the entire internal surface of the uterus, but after this has taken place only from the site of placental attachment. Very little discharge follows an abortion in the early months if it be complete; but if a portion of the ovum be retained, the hemorrhage may be great. Milk is usually secreted after miscarriage, in some instances even when that occurs quite early in pregnancy.

Prognosis. If the abortion be inevitable, of course the fœtus dies, or is already dead, and the practitioner is concerned with the interests of the mother alone. The chief immediate dangers are hemorrhage or septicæmia,[1] which may be general, or be limited to a local pelvic inflammation. Tetanus has occasionally followed. Putrid decomposition of fragments left in the uterus, according to Kleinwächter, is less common than generally believed, because of the difficult entrance of air, and because manual intervention is less frequently resorted to than in birth at the normal time.

The fatality following criminal abortion is very great. Hippocrates said that abortion was much more dangerous than labor, because the product of conception could not be destroyed except by violent means; but this remark is especially applicable to criminal abortions.

[1] In a paper upon Midwifery Among the Burmese, the author, Dr. Pedley, states that "puerperal fever is recognized by Burmese midwives, and seems to be more frequent after abortion." Transactions of the London Obstetrical Society, vol. xxix.

Tardieu states that in 116 of this class, in which the termination was certainly known, death occurred more or less promptly in 60. He refers to cases of sudden death which may be caused by embolism, by syncope, either from excessive pain or from the moral shock created by the consciousness of crime. Other causes which conduce to the fatality of criminal abortion are the secrecy with which the operation is done; usually the unhappy victim goes to the house of the abortionist, and he or she, for women are also engaged in the wicked work, endeavors to puncture or detach the membranes, possibly wounding the uterus in these efforts, in many instances "made by an ignorant or brutal hand, or one that trembles with conscious guilt." After the operation the subject walks or rides probably a long distance to her home, and there, in order to conceal all knowledge of her condition, engages in her usual avocation or work, until grave symptoms compel her to rest, and possibly to send for a physician.

The remote dangers of abortion are chronic parenchymatous metritis, very often spoken of as subinvolution, and positional disorder of the uterus; a portion of the placenta may remain and be converted into a placental polypus, or hypertrophy of undetached decidua may occur, and either be the cause of uterine hemorrhage. These dangers may be prevented in most cases by proper care during and after abortion. Unfortunately too many women look upon miscarriage as a trivial matter, and do not take the rest after it that they ought.

Treatment. The treatment may be considered under three heads, prophylaxis, that required in threatened or commencing abortion, and that of inevitable abortion.

Prophylactic Treatment. This includes a recognition of the causes of miscarriage in individual cases, and their removal. It is not necessary to repeat the etiology of this accident, nor the treatment required in different cases. In habitually recurring abortion the probability is that syphilis, or uterine retroflexion, or an endometritis is the cause.

The late Professor Henry Miller, of the University of Louisville, who was one of the first American physicians to teach and to practise the local treatment of uterine diseases, regarded inflammation of the lining membrane of the uterus as one of the most frequent causes of miscarriage, and urged the importance of properly treating the former in order to prevent the latter.

When a woman who has previously aborted becomes pregnant she should be advised to avoid all exercise at the time in the new pregnancy corresponding with that in the former when abortion occurred. So, too, rest at the times corresponding with "monthly periods" should be enjoined. Sexual intercourse ought to be forbidden.

The late Sir James Y. Simpson advised the potassic chlorate, ten to twenty grains three times a day, as a preventive; he gave it for placental disease and also as a means of arterializing the blood; it is impossible for it to produce the effect upon the blood suggested. Priestley states that many practitioners have testified to its utility as well as to its harmlessness, and suggests that it may act successfully as an alkaline salt in preventing the formation of congestive and fibrinous deposits in the placenta. A preparation from the bark of the black haw (*Viburnum prunifolium*) was recommended by Phares, in 1866, as useful in preventing miscarriage; since then it has been occasionally indorsed for this purpose by others; Wilson and Campbell[1] have recommended it very highly, sustaining the claims previously made for this medicine, that it is a tonic and uterine sedative; pills of two to four grains of the solid extract were given three or four times a day; Wood[2] states that we have no exact knowledge of the action

[1] British Medical Journal, 1886.

[2] U. S. Dispensatory, 1883.

of the remedy, and its value must be considered at present apocryphal. The dose of the fluid extract, the only preparation of viburnum which is officinal, is from half a teaspoonful to one or two teaspoonfuls, three times a day.

Some physicians, chiefly in Italy, have recently recommended asafœtida, given twice a day, in threatened abortion. The most important means, however, will be the removal of the causes which produce abortion.

In most cases, if four months have passed without abortion occurring, that is, if a previous one were before this time, the probability is that pregnancy will not be disturbed, and the patient may gradually resume a moderately active life.

Treatment of Beginning Abortion. Here the characteristic symptoms, to wit, hemorrhage and uterine contractions, are present; under only three conditions is the abortion inevitable; the first is the death of the embryo or fœtus; the second, detachment of a large portion of the ovum; and the third, rupture of the ovum. But it is in exceptional cases the physician can know at the beginning that any one of these conditions is present, and therefore his duty in all cases is to endeavor to arrest the miscarriage. The patient should at once lie down, her clothing being quite loose, the bed moderately hard, and she should be only lightly covered; her drinks should be cold—iced lemonade is very commonly given. Twenty drops of laudanum with half a teacup of warm water should be at once injected into the rectum, or an equivalent amount of opium in the form of a suppository may be used. The purpose sought to be accomplished by the opiate is to lessen the irritability and arrest the contractions of the uterus; it is claimed by some that the pregnant woman bears this remedy much better than when not pregnant. If the contractions have not decidedly abated in one hour, the injection or suppository is repeated, and again if necessary at the end of the second hour, and still again at the end of the third hour. If the patient is very nervous and restless, twenty to thirty grains of chloral may be added to one of the opiate injections, and then the vehicle should be, not warm water, but the yelk of an egg and some warm milk. When opiates are given freely, it is quite possible that retention of urine will follow, and if this is the case the catheter must be used as needed, twice or thrice in the twenty-four hours; the employment of the instrument is preferable to allowing the patient to sit up to urinate. The opium may be continued from day to day as long as there is any hope of arresting the abortion. Meantime, once in two days the bowels should be opened by a warm-water injection, or by a mild laxative. Supposing the pain and hemorrhage to cease, it is better for the patient to remain in bed for three or four days after this cessation; when she gets up she should only gradually resume her usual habits of life, even then as an experiment, and prepared to return to bed at the first recurrence of the former symptoms. Unfortunately, in the majority of cases, the pains and hemorrhage do not cease, or having stopped they return, and the abortion is apparently inevitable, or the flow may be so great that its arrest is necessary without regard to the continuance of the pregnancy.

Treatment of Inevitable Abortion. Two indications are presented—stop the bleeding and empty the uterus. The application of

cloths wrung out of ice-water, to the vulva, to the lower part of the abdomen, and to the upper part of the thighs, has been recommended; but apart from the uncertainty of this use of cold, such applications may chill the patient, and will make her uncomfortable, and may cause, if there be liability to either, an attack of bronchitis or of rheumatism. Vaginal injections of very hot water are to be preferred, both for hæmostasis and exciting uterine action. If the os be sufficiently dilated to permit immediate and complete evacuation of the uterine cavity, it should be done. And to this end firm pressure is made with one hand through the abdominal wall upon the uterus, while in some cases one or two fingers may be introduced into the uterine cavity to assist in the delivery of its contents, the greatest care being taken to avoid rupture of the ovum, if this be still entire.

In case, however, the os is but little open, some advise dilatation, especially by means of Barnes's dilators; Dr. Murphy, of Sunderland, for example, rejects the vaginal tampon, and uses them as a most efficient uterine tampon, not only arresting the hemorrhage, but making possible and hastening a complete delivery.

The most valuable, the safest, and most certain means of arresting the hemorrhage generally available is the tampon. Of course the tampon can be best applied by using Sims's speculum, but this is not essential. The following method may be satisfactorily employed in almost all cases. The vagina should be washed out with an antiseptic injection and the bladder emptied; let the patient lie on her back with flexed legs and thighs; the practitioner having provided a number of balls of absorbent cotton about the size of a hulled walnut, and some iodoform in powder, or a solution of carbolic acid, now separates the labia with two fingers of one hand, then by means of an ordinary dressing-forceps in the other hand, carries one and then another of the cotton balls up into the vaginal vault, firmly pressing them around the cervix; the balls first introduced should be covered with iodoform or dipped in the carbolized water. After filling the vaginal vault with the cotton, another layer of balls is firmly placed beneath the first, and still one or two beneath that, until at least the upper third of the vagina is completely filled, and the os uteri covered over. The use of an astringent solution, such as one of the salts of iron, is unnecessary, for by no possibility can one drop of fluid come in contact with the bleeding surface, and needless irritation, even inflammation and sloughing of the vagina, may occur if a concentrated solution is employed.

Instead of balls of cotton, strips of iodoform or of creolin gauze may be used. I have in some instances made a vaginal tampon by taking a strip of absorbent cotton, 10 or 12 inches long and about 2 inches broad; let one side of the strip be covered with a 4 per cent. creolin ointment; then seizing one end of the cotton with forceps, while the vulval orifice is kept open, it is carried up to the anterior portion of the vaginal vault, and from this as a starting-point alternate folds made posteriorly and anteriorly until the upper part of the vagina is completely packed, a second and a third strip being used if necessary. The special advantage of this method of using cotton as a tampon rests upon facility of application and of removal.

In only rare cases will it be necessary to tampon the entire vagina, and secure the packing by a T-bandage. The tampon is a perfect safe-

guard against hemorrhage, but it must be of suitable material and properly applied; let no practitioner in this or any other case of uterine hemorrhage delude himself by trusting a tampon of sponge. The advantages of the tampon in abortion are, not only in the arrest of external hemorrhage, but its pressure evokes uterine contractions, and the small quantity of blood escaping from the detachment of the ovum is now shut up in the womb, and passes between the former and the uterine wall, perfecting the separation, and thus facilitating complete discharge. The tampon may be left in place twelve or twenty-four hours, perfect antisepsis having been observed in its application. Upon its removal the ovum will in many cases be found in the upper part of the vagina, or it may have entered the cervical canal, and so completely fill it that a repetition of the tampon is unnecessary; in the latter case firm compression of the uterus may finish the expulsion of the ovum; even before the descent into the canal, delivery by expression is sometimes successful.

The general practice is to give ergot when there is much hemorrhage; but if the cervical canal is undilated, it is claimed by some that the medicine contributes quite as much to the imprisonment as to the expulsion of the ovum. This objection is completely removed if the tampon be used when ergot is administered. Ergot and the tampon are remedies that act admirably when associated in these cases. The practitioner in cases of miscarriage in the first three months must be especially careful not to rupture the ovum, for if the amnial sac be opened there is great danger of the abortion being incomplete. In case hemorrhage persists or returns, the abortion not yet having taken place, the tampon is to be repeated, and with the repetition ergot may also be used.

While in the great majority of cases under this treatment the ovum is expelled entire, in some the embryo or the fœtus is discharged, but the appendages retained; or the case may be one in which the abortion was begun by perforating or puncturing the membranes. If the pregnancy has continued as long as four months, usually expression will cause the expulsion of the placenta and membranes; if necessary, this expulsion may be facilitated by digital or other dilatation of the os uteri. These cases as a rule do not present serious difficulties, though there may be delay and difficulty in completely emptying the womb.

But if a miscarriage occurs in the period from seven to ten weeks, and immediately after the expulsion of the embryo the cervical canal closes, what practice is to be pursued? Some insist upon immediately emptying the uterus by means, if necessary, of instruments, either forceps, curettes,[1] or Simon's spoon. Certainly when miscarriage is incomplete, there is a possibility of serious dangers, but, on the other hand, hasty interference is not free from peril; the appendages are retained either because still attached to the uterus, or because of the obstacle presented by the narrowed cervix. If attachment prevents their discharge, they are a living part of the uterus, and tearing them away in itself is a traumatism, while rude efforts in this process may inflict additional traumatism, and as fragments are almost inevitably left behind,

[1] I am glad to read the recent statement of Ahlfeld: Curetting is almost always unnecessary. Wounds from the curette are unavoidable.

the detachment is incomplete; moreover, their presence in the uterus may for a time give rise to no symptoms.[1] But, on the other hand, if partial or complete detachment has occurred there will be hemorrhage; or if retention is permitted for a day or two, in addition to the hemorrhage there may be an offensive discharge. Now, the indications for active interference are unequivocal, and delay is perilous. In these cases gradual dilatation of the os may be effected by tupelo tents or a rapid dilatation by Hegar's hard-rubber dilators, and this is the preferable plan, the patient being anæsthetized if thought best. After the dilatation the uterine cavity is disinfected by washing it out with a 3 per cent. solution of carbolic acid in warm water, and one or two fingers made aseptic and dipped in an antiseptic fluid—one teaspoonful of creolin, for example, in a pint of water—are passed into the uterine cavity, while the other hand upon the hypogastrium presses the uterus down upon the internal fingers; or, as advised by Dr. Alexander R. Simpson, the uterus is drawn down to the mouth of the vulva by the volsellum, and then one or two fingers introduced. In either case the membranes are detached by the fingers and brought down to the os; in some instances the finger and thumb may be used like a crab's claw, as Mauriceau expressed it, to seize them and draw them out.

But if digital detachment fails to remove the remains of the ovum, I have found the following an excellent plan The practitioner has at hand a basin of warm carbolized water, Churchill's tincture of iodine, Emmet's curette forceps, a uterine tenaculum, one or more applicators, a uterine probe, absorbent cotton, and a bivalve speculum—Neugebauer's answers admirably. The patient now has her hips brought to the edge of the bed, and the thighs and legs strongly flexed; after the introduction of the speculum and exposure of the os, the tenaculum is inserted into the anterior lip from below and firmly held, so as to fix the womb, and also used to straighten any flexion that may be present; next the uterine probe is introduced to ascertain the size and direction of the uterine cavity, after which the blades of the curette forceps, first being dipped in the carbolized water, are passed into the uterus, then opened, the ends pushed on until touching the uterine wall, when they are firmly closed and withdrawn; upon withdrawal they will be found to contain fragments of membranes which may be removed by opening them and moving them to and fro in the carbolized water; the process is repeated, and all parts of the uterine cavity, especially the vicinity of the entrance of the oviducts, thoroughly explored, and membranes detached and removed. After completing the removal of membranes, or placental fragments, the uterine cavity is swabbed out with the iodine solution, or, better, an injection of iodine made with Braun's syringe; iodine is both an excellent antiseptic and uterine hæmostatic.

[1] Charles says: We do not advise immediate efforts for the removal of the after-birth in abortions before four months, while after this period we recommend acting as soon as possible in the artificial delivery as after labor at term. The conditions are different. 1. The danger from retention is much less. 2. The introduction of the hand is impossible because of the narrowness of the cervical canal and the smallness of the uterine cavity. 3. The dilatation of the orifice and the introduction of instruments designed to extract the placenta are dangerous, difficult, and painful; these instruments act blindly, contuse, lacerate the uterine walls, and rarely succeed in removing all the secundines, but almost always cause metritis. In a word, the danger from retention is much less than that of extraction.—Journal d'Accouchements, June, 1885.

Doubtless some will think that the practice advised in incomplete abortion of the earlier weeks, when there is closure of the cervical canal after the expulsion of the embryo or fœtus, and no symptoms demand interference, too conservative. But I can fully adopt the words of that wise obstetrician, the late Dr. Churchill, "Longer experience has made me less fearful of leaving these cases to nature, and more unwilling to interfere hastily." The probability is, that they will end within a few days by the spontaneous expulsion of the uterine contents; meantime the practitioner carefully watches the case, directs antiseptic vaginal injection twice a day, and is ready to meet any dangerous symptom and to assist nature's process; his position is not that of simple expectation, but of armed expectation, as a French obstetrician has expressed it.

It is satisfactory to the writer to know that the conservative treatment—conservative in opposition to the radical methods advocated by many authors in recent years—presented in previous editions of this work and now repeated, is in perfect correspondence with that of Winckel in his work upon obstetrics. This eminent and able practitioner, with an experience which is the fortune of few, uses the following language:[1] "I maintain that if, in an abortion or immature labor, fragments of fœtal membranes or placenta have remained behind, we are justified and obliged to proceed to operative interference only when there are severe hemorrhages from the uterus, or fever or sloughing occurs. In the absence of these indications I am strongly opposed to cleansing the uterus, either by hand or by instruments, because this method furnishes no guaranty against small fragments being left behind and against direct inoculation of sanious matter into existing lesions. If the placenta remain behind and the inetrnal os closes, or permit at most the introduction of one finger, or even if an exudation can be detected in the neighborhood of the uterus, we must desist from any attempts at entering the uterus, but should administer ergot, irrigate the uterus daily through a Fritsch or Budin catheter with an antiseptic fluid, such as solutions of boric acid, carbolic acid, or of potassic permanganate, or chlorine-water, and as a rule we will find that in from two to ten days the placenta is completely and safely expelled."

The course in incomplete abortion[2] advised by Tarnier and Budin is also conservative.

Last year Professor Schauta, of Vienna, made a valuable contribution to the subject of the treatment of abortion; some of his directions in the management of abortion will now be presented. He condemns active intervention at first, so strongly advised by some authors, and is content with meeting the first symptom, hemorrhage, by a vaginal tampon of iodoform gauze; it is not necessary to use the speculum. If after introducing the tampon the pains are severe enough to cause the expulsion of the ovum, the latter will be found upon removal of the former. But the contractions not having effected this expulsion, the tampon is removed at the end of twenty-four hours, and after its removal the neck is found dilated or not, and the hemorrhage has ceased or continues. If the neck is not dilated and the hemorrhage has ceased, no immediate intervention, but wait—possibly abortion may not occur.

But if the neck is partially dilated, and bleeding continues, a fresh tampon, and this, if necessary, is replaced by another at the end of twenty-four hours. In acting thus the ovum is completely detached and is entirely expelled. Occasionally, after tamponing several days, it may happen that the neck will admit two fingers, nevertheless the ovum remains. This fact shows that the ovum is adherent, and its adhesions must be artificially ruptured; for this end two fingers are passed into the uterus, pressed down so that the fingers reach to its fundus, and then they are carefully used to detach the ovum, when the hand is withdrawn and simple pressure upon the uterus usually causes expulsion of the ovum; if this does not occur, use forceps, and if bleeding follows tampon the uterus with iodoform gauze, the tampon remaining twenty-four hours. In those cases to which the practitioner is first called, when the uterus has lessened in size, the neck not dilated, and hemorrhage continues, there are fragments of the membranes retained, and dilatation is necessary, preferably by Hegar's dilators. Let the finger be used after this dilatation to remove the retained fragments, and if

[1] Edgar's translations.
[2] Traité de l'Arte des Accouchements, tome deuxième.

not thus succeeding, then the curette, guiding the instrument by the finger and using it only upon those parts where there are such adherent fragments; he condemns blind general curetting the endometrium. I am very glad to introduce this condensed statement of Professor Schauta's method; I hope his practice and counsel will do something toward checking the radical treatment of abortion, which has, in my opinion, come too much in vogue.

After-treatment. The patient remains in bed at least a week after a miscarriage, for frequently permanent invalidism is caused by neglect of proper care at this time.

Missed Abortion. Sinclair,[1] in a paper upon this subject, classifies cases of missed abortion as follows: (1) those in which expulsion occurs spontaneously before the end of pregnancy; (2) those in which expulsion takes place at or about the full period of pregnancy; and (3) those in which the ovum is retained beyond the full period of pregnancy. He shows from statistics that the accident is very rare in primigravidæ; he also calls attention to the fact that while in a large number of cases the expulsion of the ovum is apparently spontaneous, in others a slight disturbance, in one instance a vaginal examination, determines the expulsion, remarking "It would seem as if there was a kind of equilibrium between the retentive and expulsive forces, and that this equilibrium could be readily upset by any influence capable of slightly increasing the force of the uterine contractions."

The indication in missed abortion is to empty the uterus. In some cases, as in one reported by Matthews Duncan, the introduction of a bougie will be sufficient to excite the uterine contractions; in others it may be necessary to dilate the os uteri with tupelo, or with Hegar's dilators.

In concluding the subject, a single word upon criminal abortion. The temptations to this offence probably come to every physician. He will be appealed to by the unfortunate victim of man's passion and perfidy to save her and her family from disgrace, and his sympathies will unite with the teaching of some utilitarian theories of morals to stifle the voice of conscience; family friendship will be plead by the married woman already a mother, who does not wish to have any more children; or finally, the baser motive of avarice will be invoked, and he may be promised a far more liberal sum than led Judas to be chief contributor to the crime of the ages. But he must turn a deaf ear to all these appeals. "Heart's blood weighs too heavily," and let him beware of violating both human and Divine law, no matter how great the temptation.

[1] Journal of the British Gynecological Society, 1887.

SECTION II.

THE PATHOLOGY OF LABOR.

Introductory. The pathology of labor includes anomalies of the forces that expel the ovum and secure subsequent normal contraction of the uterus; anomalies of the passage through which the fœtus is transmitted, and anomalies of the fœtus itself, whether deviations in position, in size, or in form; finally, the accidents which may occur in a labor, or immediately follow it, such as rupture of the uterus and post-partum hemorrhage, must be considered. Of course, anomalies of the passage will embrace deformities of the pelvis, just as the therapeutics required in certain pathological conditions will include obstetric operations.

I. Anomalies of the Forces concerned in Labor. These anomalies relate chiefly to the uterine force. This force may be abnormal by excess, by deficiency, or by perversion.

a. Excess of uterine force. In those cases in which the uterine contractions are strong and recur rapidly the labor has a speedy[1] end without danger to mother or child, provided the latter present favorably, and the birth-canal offers no serious obstruction, and suitable precautions are taken. But in the absence of proper care delivery may surprise the woman while she is standing, or while[2] she is upon a commode or in the water-closet, and the child be injured, the cord torn, the uterus inverted, or relaxation follow the violent uterine action, and hemorrhage result. Again, if the os or the perineum does not yield readily, a tear in one or both may occur from excessive uterine action; an injury to the former is less likely to occur than to the latter.

Emphysema of the Neck, Face, and Chest. If voluntary efforts in labor are very great, especially in primiparæ, it sometimes happens that rupture of some of the air vesicles occurs, and emphysema of the neck, face, and chest follows. Blundell[3] has spoken of the condition as follows: "It is not frequently that a disruption of the larger air-tubes occurs in the progress of laborious parturition; yet this accident is sometimes observed, the trachea or bronchi giving way. After much exertion, the neck and face swell, from the hurrying of the circulation, an erythematous flush of the integuments is produced, and at first glance the patient appears to labor under a sudden attack of erysipelas; the nature of the swelling manifesting itself on making an examination by the usual crepitus perceived on compressing, and lightly shampooing the skin with the tips of the fingers. Should emphysema occur, delivery is desirable. To retain the breath and force down is likely to aggravate the disease, so that the emission of the voice may be

[1] The old authors described it as *partus præcipitatus*, precipitate birth.

[2] If a woman is delivered standing, it is rare that the child is seriously injured by falling on the floor, because the force of the fall is broken by the limbs of the mother and by the resistance of the cord, though the latter be ruptured by the sudden strain.

[3] Principles and Practice of Obstetricy.

recommended. After delivery, if I may judge from the single case brought under my notice, the aperture, seldom capacious, heals spontaneously, and without inflammation the air is absorbed."

The swelling and the characteristic crepitation clearly indicate the nature of the accident. The emphysema, if not very great, disappears spontaneously in five or six days. Of course, the patient is not permitted to continue any voluntary effort, but the labor must be terminated by the sole force of uterine contractions, or by instrumental delivery.[1]

As has been previously stated, very active uterine contractions are not to be regarded as pathological in a normal condition of the birth-canal, and normal presentation and size of the fœtus, and, therefore, usually require no direct interference. The woman must be in bed, and lying upon one or the other side; she is advised not to make any bearing-down efforts, but keep her mouth open, refrain from pressing against any object with her feet, or grasping one with her hands during a uterine contraction. But if the unyielding condition of any portion of the birth-canal renders tearing probable from the rapidity of the labor, free inhalation of chloroform must be used to moderate the uterine force. Care must be taken in the third stage of labor to see that the uterus undergoes its normal retraction.

In some cases violent contractions of the uterus may be the consequence of too early rupture of the membranes, or frequent and rough examinations, or improper efforts to dilate the os with the fingers or other mechanical means, in short, of "meddlesome midwifery"; to mention the origin of the evil is to suggest its prevention.

b. Deficiency of uterine force. Here the uterine contractions fail in intensity, in duration, and in frequency; this condition results in "tedious labor." Feebleness of uterine contractions is much more frequently met with than the condition just described, and it may occur in any one of three stages of labor, though most frequent in the first. It varies in degree and continuance, and may end in an actual cessation of uterine activity, which is commonly known as inertia of the uterus. The immediate danger to the mother from weak uterine contractions is greatest in the third stage of labor—for then hemorrhage is the inevitable consequence. Delay in the first stage of labor if rupture of the membranes has not occurred is not attended with risk to the child, or immediate peril to the mother; indeed, in very many cases she suffers no injury, immediate or remote, from this delay. But if the amnial liquor has been discharged some risk comes to the fœtus, though probably this is not usually so great as has been thought, for complete emptying of the liquor is exceedingly improbable; especially if the vertex presents, there usually remains filling up the interstices in the fœtal ovoid a considerable quantity of the fluid, so that the cord is protected from injurious pressure. Most practitioners of even a few years' obstetric experience have met with cases in which spontaneous rupture of the membranes occurred twenty-four hours, or even three or

[1] In the British Medical Journal, October 24, 1885, a case of emphysema in labor is reported, in which the entrance of air into the connective tissue of the neck and upper part of the chest, is supposed to have occurred through a small denuded surface about the middle of the right cheek in the cavity of the mouth—certainly a very singular hypothesis.

four days before labor began, yet in most instances it ended in the birth of a living child. Delay in the second stage of labor is serious for both mother and child, for supposing the head to have entered the pelvic cavity, it may produce by continued pressure upon the mother's soft parts inflammation and sloughing, with consequent rectal or vesical fistulæ; even if these accidents do not happen, the injury to tissues opens the door for septic infection; the child suffers from prolonged pressure, and fatal asphyxia is the not uncommon consequence. The mother's life is endangered by the exhaustion which follows long-continued powerless labor.

In some cases at the close of the first stage of labor, and immediately after the evacuation of the liquor amnii, a pause occurs in the labor; there is an absence of uterine contractions, or these are very feeble, and this condition may, though it is not common, last some time unless means are used to evoke the languishing, or the delayed uterine force. The patient, usually a multipara, is herself surprised that the pains have ceased; the practitioner, upon making a vaginal examination, finds the head still within the uterus, the cervix perfectly relaxed, and its walls hanging in loose folds, and a perfectly normal condition of the remaining portion of the birth-canal; a few vigorous pains, assisted by abdominal efforts, are apparently all that is needed to effect the expulsion of the child. Longer labor-pauses sometimes occur before the discharge of the amnial liquor; labor has come on, and some degree of dilatation of the os been accomplished; then uterine action, which has been manifest for hours, gradually ceases, and the patient goes to sleep, often to the surprise, if not the disappointment, of attendants, who expected that in a short time the labor would be over; twenty-four hours may pass before the labor is resumed. Such cases are not to be regarded as pathological; the cessation of uterine contractions is very different from that observed when the uterus has for hours vainly struggled against some invincible obstacle, until its force is exhausted. The condition last mentioned is most frequent after the rupture of the membranes, and in the second stage of labor.

Voluntary force may be feeble, the abdominal contractions failing to contribute their part to the progress of the fœtus. This failure, in the majority of cases, occurs when uterine contractions are attended with much suffering; the patient refrains from effort lest she may add to that suffering. Again, voluntary effort may fail from the general weakness of the patient or from her being profoundly narcotized.

Causes of Weak Pains. Failure of uterine force may arise from previous exhaustion, or from that caused by protracted labor; the uterus has grown weary in its work, and falls into a condition of inertia. It may be the result of deficient uterine innervation, or it may be caused by excessive uterine distention, as from polyhydramnios, or from the presence of more than one fœtus; the upper portion of the uterus being thus thinned, it cannot triumph over the normal resistance of the os. A full bladder or a loaded rectum may hinder normal uterine action. Kleinwächter has drawn attention to the fact that failure of uterine contractions may result from an artificial cause, as, for example, if during the course of labor the forceps is applied and unsuccessful attempts at extraction are made, the labor-activity may be permanently interrupted. Mental influences may, temporarily at least, cause the labor to lag, the uterine contractions becoming weak and inefficient. A woman depressed by fear or anxiety, or offended by the presence of someone to whom she has an antipathy, or wounded by the unkindness of another the nearest to her, and to whom she ought to be the dearest

in this her hour of sore trial, and possibly of great peril, may have weak uterine contractions thus caused.

Prognosis. This depends upon the stage of labor in which feeble pains occur; upon whether the membranes have been ruptured or are still entire; upon the causes of the condition; upon the general state of the mother, and upon that of the child. In the first stage of labor, the membranes being unruptured, as a rule the child does not suffer; but the prolongation of the first stage is in many cases not a matter of indifference as far as the mother is concerned, for she may be deprived of sleep, become discouraged by the delay, and exhausted by her fruitless suffering, which exceptionally continues for several days. Charpentier mentions a case in his practice in which dilatation was not accomplished, notwithstanding all means employed, until five days; the delivery was then made by forceps. In Greek mythology a case in which labor lasted nine days is given.[1]

The gravity of the condition, if it occurs in the second or in the third stage of labor, has been sufficiently pointed out.

Treatment. Here we must carefully distinguish between physiological and pathological labor-pauses, for in the former we abstain from active interference, while in the latter it may be imperative, and often must be prompt. Again, for their wise treatment a recognition of the causes of weak pains is essential, and also the period in labor of their occurrence, and the condition of mother and of child. If the contractions are attended with excessive suffering, we have in chloral one of the best agents for its relief. If feeble uterine contractions occur in the first stage, wearying and exhausting the patient, while dilatation of the os almost, if not quite, fails, the membranes being unruptured, we may imitate nature's action in many cases, and create a temporary labor-pause by the administration of morphine; after a sleep of a few hours it is not unusual for uterine action, thus temporarily suspended, to return with normal vigor. The practitioner should know that the bladder and rectum are completely emptied. When uterine contractions fail from deficient innervation of the uterus, a change of position, especially from the recumbent to the erect, or walking for a time, may produce a favorable effect. Similar action may be accomplished by a stimulating rectal injection, or by hot-water vaginal injections; taking a moderate quantity of food, a cup of hot tea, or a glass of hot lemonade is in some cases followed by increase of uterine action. If the uterus fails to contract because of its excessive distention, rupture of the membranes is indicated, though the os is only partially dilated, but dilatable. Even if there may not be obviously great uterine distention, partial evacuation of the amnial liquor is often followed by vigorous uterine action. But this should only be done if the presentation is normal and the position favorable, and the os at least half-dilated and dilatable. Hasty intervention is, in the majority of cases,

[1] Latona, pregnant by Jupiter, and her labor at hand, was pursued by jealous Juno, and at last found secure retreat in the island of Delos. Her labor lasted nine days and nine nights, when, seizing hold of a palm tree, she gave birth to Apollo, the god of medicine and of music. The position she took to end a protracted and difficult labor might be adduced as an argument in favor of delivery being effected while the woman is erect or leaning forward. It may also be mentioned that from the legend we learn that Artemis, the twin sister of Apollo, was born twenty-four hours after—an interval that, as has been previously stated, may sometimes occur in the birth of twins.

more dangerous than expectation. The introduction of Braun's colpeurynter into the vagina, or of a flexible bougie into the uterus, placing it between the ovum and the uterine wall, has been used for the purpose of exciting uterine action, and each has sometimes been successful. But, of course, if these means are used very strict antisepsis must be observed. Friction of the uterus by the hand upon the abdominal wall may sometimes be useful. Runge commends an entire bath, temperature of 95° F., continued for one-half to three-quarters of an hour in cases of prolonged labor, especially if the temperature increases, the general condition being thereby improved and the uterine activity revived.

The use of the forceps in the first stage of labor after the rupture of the membranes, not for the purpose of extraction, but simply to bring the head down so as to press upon the os uteri during uterine contractions, and effect dilatation, has been advocated, in this country especially, by the late Albert H. Smith,[1] and by Professor Isaac E. Taylor.[2] The former has given the following directions as to this use of the forceps: When the os uteri is sufficiently dilated to allow the introduction of the blades, they may be carefully applied, and during each uterine contraction the head may be drawn down gently, and with as little compression as may be required to keep the blades in place. We have then nature's own dilator, supplemented by art simply for the increase of its powers, without any change in the method of action, no new plan of operation being introduced. The application of the forceps before the os is dilated can only in exceptional cases be proper. Digital dilatation of the os uteri will generally prove in cases demanding intervention, after spontaneous and premature rupture of the membranes, a better method than the use of the forceps, at least in the hands of the majority of practitioners. Dilatation by means of rubber bags may in some cases be substituted for that by the fingers. Artificial dilatation can, as a rule, be more readily effected if chloral be first given. In labor delayed by insufficient uterine contractions fœtal expression has been proposed by Kristeller,[3] and advocated especially by him and by Suchard,[4] though Kleinwächter states that it accomplishes no more than friction of the fundus of the uterus.

The following are the directions given by Kristeller for the application of this method:

The patient lies upon her back, near the side of the bed; by percussion and palpation the limits of the uterus are defined, the neighboring organs are isolated, and the intestinal folds separated. If the uterus incline too far anteriorly or laterally, it is brought into the axis of the inlet. It is then embraced by the hands, their cubital border being directed toward the pelvis, and their palmar face applied to the sides and to the fundus of the uterus, the thumbs being upon the anterior face. The fingers are now directed as far as possible behind the uterus; this succeeds very easily in the case of a multipara whose abdomen is relaxed and yielding, and in a pluripara after the birth of one child. Next press gently the abdominal walls against the uterus thus embraced at the superior part; gradually increase the pressure; after keeping up this pressure for a certain length of time, it should be gradually diminished. The pressure upon the fundus of the uterus should be directed from above below, while that upon the sides converges toward the axis of the organ. The duration of the compression will vary from five to eight minutes; it may be repeated at intervals of from one-half a minute to three minutes during a period of ten, twenty, or forty minutes, according to the urgency of the case, the period of labor, and the sensibility of the patient. In the succession of intermittent compressions thus made, it is sometimes necessary to act upon the fundus, sometimes upon the upper and lateral portion of the uterus, never forgetting that when the os is but

[1] Medical and Surgical Reporter, 1877.
[2] Transactions of the American Gynecological Society, vol. iv.
[3] Monat. f. Geburt., 1886.
[4] De l'Expression Utérine appliquée au Fœtus.

slightly opened, not readily dilatable, and its diameter not more than five centimetres, nearly two inches, the pressure should be less upon the fundus, more upon the sides of the uterus. On the other hand, when the os is more dilated and yielding, compressions of the fundus produce the best effects. In difficult cases a longer pause, from ten to fifteen minutes, should be made after ten or fifteen compressions. Toward the end of the labor the place of applying pressure should not be changed; it can scarcely be made except at the fundus of the uterus. Kristeller directs that, as a rule, if twenty to thirty compressions properly made produce no result, it is better to desist.

Electricity, whether faradism or galvanism, is not so uniformly efficient in exciting uterine contractions, nor are the means for employing it usually available, that it can be advised.

Internal Means. Medicines may be administered for increasing uterine contractions; the chief of these are quinine and ergot. It is asserted by reputable observers that the former given in doses of ten to twenty grains has this effect. Wood[1] attributes the result not so much to a specific action of the remedy upon the uterus as by its arousing the general nervous forces of the system. Kleinwächter explains the apparently beneficial effect of quinine as resulting from reduction of abnormal temperature; after the fever abates the pains frequently increase spontaneously, and succeed each other rapidly, but not in consequence of the quinine.

The late Dr. Albert H. Smith stated[2] that in forty-two women, to each of whom he gave fifteen grains of quinine after actual labor-pains had begun, he observed within fifteen minutes a decided increase in the frequency and vigor of the contractions, a rapid progress of the labor, and, where there was no obstruction, a speedy termination. He claimed that quinine not only increased the activity of the normal uterine contractions, but that it promoted permanent tonic contraction of the uterus after the expulsion of the placenta, that it lessened the lochial discharge in those who previously had it in excess, and that it also lessened after-pains in the majority of cases. Still, beneficial results from it are by no means constant.

Ergot has been more generally given than any other agent to increase uterine contractions. Wernich's investigations show that it lessens venous tension, and while the blood in the veins increases, that in the arteries diminishes; anæmia of the uterus and its nerve-centres occurs, and hence the uterine contractions become more powerful and longer. According to Wood's statement,[3] if ergot be given in small doses during labor, the natural pains are simply intensified; but if the dose be large enough to have a decided effect, their character is altered; they become not only more severe, but much more prolonged than normal, and finally the intervals of relaxation appear to be completely abolished and the intermittent efforts are changed into one violent, continuous strain.

Ergot was introduced into American practice in 1807,[4] and received the name of *pulvis ad partum;* but as fatal results at least to the child followed its use, Dr. Hosack suggested that it should be called *pulvis ad mortem*. Many reputable obstetricians to-day reject the use of ergot during labor, some indeed insisting

[1] Therapeutics, Materia Medica, and Toxicology.
[2] Transactions of the College of Physicians of Philadelphia, 1875.
[3] Op. cit.
[4] Medical Repository, 1807.

that it should be banished from obstetric practice. It is believed that this is a mistake, and it is unjust to conclude that because there has been gross abuse in the administration of the agent—it has been given in unsuitable cases, at improper times, or in too great quantities—it should therefore not be used at all.

Säxinger found good results from it in weak pains, and never any injurious effect upon the child. Schutz[1] maintains that ergot, in suitable doses, excites normal contractions.

The form in which it is most frequently given is that of fluid extract, each minim of which represents one grain of powdered ergot. A preparation called ergotine, though Squibb denies the right to this name, is also used; each grain of ergotine is supposed to represent five minims of the fluid extract. The remedy is given by the mouth, and also used hypodermatically, in the latter case a watery solution of ergotine usually being preferred.

Ergot is not to be given in the first stage of labor. Exceptions to the rule are very few. Next, it should not be given unless the labor be so far advanced, and the conditions of presentation and of the birth-canal are such that an early delivery may be reasonably expected if the uterine force be made normal. The most important rule in regard to its administration is that it must be given in such amount that the normal contractions of the uterus shall be increased; the use of large doses, so that continuous action is excited, may be followed, and too often has been, by rupture of the uterus, of the vagina, or of the perineum, and by the death of the child from asphyxia. Ten drops of the fluid extract, or an equivalent quantity of the infusion, or of ergotine, once in fifteen minutes, is a suitable dose when the remedy is required during labor; if given for uterine inertia after labor, the dose should not be less than a teaspoonful. Kleinwächter advises combining Wernich's ergotine with tincture of cinnamon, a teaspoonful of the latter at each dose, stating that it then acts more efficiently; it might be well, therefore, to give ten drops, for example, of the fluid extract with a teaspoonful of the tincture of cinnamon in two tablespoonfuls of water.

If after the rupture of the membranes and complete dilatation of the os labor does not advance, instrumental delivery will in many cases be best, both in the interest of the mother and of the child.

Feeble and inefficient uterine contractions in the third stage of labor usually have as their consequence placental retention and uterine hemorrhage, and will hereafter be considered.

Dr. Duff, of Pittsburg, advises that strychnia be given, beginning six or eight weeks before labor, to women suffering from general debility and relaxed muscle, and who have suffered in previous deliveries from feeble and irregular uterine contractions, causing tedious parturition, and, moreover, to those who have had post-partum hemorrhage and failure of uterine contraction and retraction.

c. Perversion of uterine force may be manifested by continuous general or by partial contraction; the former is sometimes called tetanic, while the latter causes what is known as spastic stricture. Tetanic or continuous contraction of the uterus occurs oftener in old primiparæ; it may be caused by ergot given at an unsuitable stage of labor, or in too large a quantity; by irritation of the os from frequent examinations or other interference with the progress of labor, or result from dispro-

[1] Deutsch. Gesellschrift f. Gynäkol. Congress, 1890.

portion between the size of the fœtus and the pelvis, or from a malpresentation, as of the shoulder, the uterus struggling to overcome great or invincible resistance. The condition is generally attended with severe suffering. This condition, too, makes difficult or impossible the introduction of the hand into the uterus for rectifying an unfavorable presentation or position. It usually occurs after the rupture of the membranes, and hence may interfere with the utero-placental circulation or produce direct pressure upon the cord, and in either case the child perish from asphyxia; premature detachment of the placenta is not uncommon.

Chloroform given until deep anæsthesia is produced will be necessary in cases demanding an obstetric practice, *e. g.*, podalic version in presentation of the shoulder. Fränkel advises a hypodermatic injection of morphine and of atropine to be given before the chloroform inhalation; in five or ten minutes the uterus relaxes, and the introduction of the hand can be readily made.

One of the dangers from tetanic contraction of the uterus is rupture; and if this contraction cannot be abated, Kaltenbach advises delivery of the child even by embryotomy.

Spastic Contraction. Partial uterine contraction is usually an accident of the third stage of labor; in its most common form it is known as hour-glass contraction. In the great majority at least of these cases the condition is not pathological; there is general contraction of the uterine body, while the cervical canal remains relaxed, and the apparent stricture is the normally contracted internal os, while the placenta remaining in the uterine cavity prevents the complete approximation of its walls.

Kleinwächter denies the existence of partial uterine contractions or partial uterine spasms, but asserts that in consequence of the relations of the muscular fibres to each other the uterus must contract as a whole. The so-called spasmodic contraction of the external os uteri is nothing more than a condition in which the upper part of the uterus has not manifested enough power to overcome resistance; the os is only slightly dilated, and it presents sharp edges, but as soon as the contractions have become more vigorous it opens, and the so-called spasm ceases. Again, in the third stage of labor, the placenta may not be detached spontaneously, in consequence of adhesions, and the uterus takes the form of an hour-glass The relaxed lower uterine segment represents a funnel, the narrowest portion of which is above. The upper portion of the uterus contracts around the remaining placenta, and immediately below the walls of the body meet, as nothing intervenes; but the lower segment is found, as after every normal birth, in a condition of partial paralysis—that is, it is relaxed. The so-called stricture, therefore, is not a pathological phenomenon, but is the normal condition after the delivery of the child. While this is the most frequent form of stricture, and, as Kleinwächter states, is not a pathological condition, yet the recent investigations of Bayer[1] seem to prove that from the anatomical construction of the uterus strictures may occur at various parts of the organ. Clinical observation, too, confirms this view, though the occurrence of such cases is exceedingly rare.

But this ring-like stricture at the os may occur in head-last as well as in head-first labor, so that it acts as a cord around the neck of the fœtus, preventing in the one case the delivery of the head, and in

[1] Op. cit.

the other that of the body. Incision of the unyielding band may be necessary, if digital dilatation fails, for saving the child's life.

Kaltenbach narrates a case which he regards as of importance in a forensic point of view: In a woman twenty-four years old, in her fourth labor, the head of the child on the pelvic floor; delivery with forceps was necessary from delay, and a dead child extracted with difficulty. The head and upper part of the throat showed a deep, bluish-red discoloration, at the middle of the throat a furrow; there was no coil of the cord about the neck. Such a condition might have been mistaken, under other circumstances, as proving infanticide from strangulation.

Great Pain. Excessive suffering in labor may be caused by very great distention of the uterus, by peritoneal inflammation, by malpresentation or great size of the fœtus, or it may arise from a general hyperæsthetic condition. It does not interfere with the action of the uterus, but it does prevent the assisting action of the abdominal muscles in the second stage of labor.

In the treatment of excessive pain, of course, the cause must be ascertained, and, if possible, removed; but in many cases remedies must be given directly for the suffering; thus we may use chloral or laudanum by rectal injection, or morphine hypodermatically, or anæsthetic inhalation.

Anomalies of the Soft Parts. These will include not only anomalies of the uterus as to development and position, as to the condition of the os and the cervix, and as to neoplasms, but also certain deviations of adjacent organs from the normal.

Anomalies of Form and of Position of the Uterus. The arrest of pregnancy in a rudimentary horn of the uterus has been stated in connection with the subject of ectopic development of the ovum. But in the cases in which the pregnancy has occurred in the fully developed horn, either of a uterus unicornis or bicornis, its course has been uninterrupted and the labor normal; nevertheless, in some instances of the latter malformation it is stated that the unimpregnated horn has interfered with the entrance of the fœtus into the vagina, and that there is a greater liability to a transverse position of the fœtus. Instances have occurred in which both horns were pregnant, the labor taking place in each at or near the same time; in other cases there has been an abortion from one horn, while the pregnancy in the other was completed.

Cruveilhier has mentioned a curious instance of double uterus with duplicity of the vagina also, the woman being pregnant; she was visited by one physician who asserted that she was not pregnant, and then by another who found her in labor; the difference of opinion arose from the fact that one practitioner made a digital examination through the vagina, which communicated with the non-pregnant half of the womb, while the second, making his through the other vagina, recognized the dilatation of the os and the presenting part of the fœtus.

Latero-positions of the uterus, though usually rectified by uterine and abdominal contractions bringing the uterine in correspondence with the pelvic axis, can easily be corrected, if necessary, by having the patient lie upon the side opposite to that of the displacement. Anteversion or anteflexion is remedied simply by the dorsal position or by

the abdominal bandage; Dr. Barker[1] stated that in some cases of pendulous abdomen he has been obliged to place the patient in the dorsal position, her head and shoulders being considerably lower than her hips.

Prolapse of the uterus can only occur in case of a very large pelvis; very rarely the head passes out still inclosed in the lower uterine segment.

Occlusion and Narrowing of the Os Uteri. Conglutination of the external orifice is occasionally met with. The labor is tedious, the lower uterine segment greatly thinned, and upon digital examination no os can be felt, but usually a slight pit or depression marks its place, though sometimes this may fail; the closure in most cases is simply from a thickened secretion, but may be consequent upon a superficial endometritis. During a contraction of the uterus pressure should be made with the point of the finger or with the uterine sound at the depressed place, or if this be absent, at that which is most thinned, and the os will open; it may be widened simply by the finger, or, as in a case[2] reported by the late Dr. Albert H. Smith, by means of a uterine dilator.

In rare cases it happens that the union between the maternal and fœtal membranes in the immediate vicinity of the external orifice is so firm that the lower segment of the uterus cannot retract over the ovum. Should this be the case, detachment of the membranes or rupture of the sac is indicated.

Cicatricial closure of the os may have resulted from an inflammation following a previous labor, or from the application of powerful caustics to the cervix. It is rarely complete, and if there be atresia, of course, it must have originated subsequently to impregnation.

Undoubtedly, in some of the cases in which atresia of the os was diagnosed there had been only stenosis. Failing with the finger to discover the os, the next step will be to expose, by means of a speculum, the parts, and then there will usually be seen at the os a little mucus projecting, or, if the membranes have ruptured, and especially during a uterine contraction, there will be discovered a small stream of water escaping.

Of course, if it be a simple stenosis, or conglutination, pressure with the knob of a uterine sound will open it so that dilators or the finger may be used. But if atresia is present an incision is necessary; Winckel advises a superficial crucial incision; antisepsis must be carefully observed. In a case of this kind, seen two years ago with Dr. Markley, of Hatboro, Pa., neither he nor I could discover the os, and I made with scissors a cut through the thin tissue where I believed the os ought to have been; this opening readily dilated, and the labor was ended by forceps.

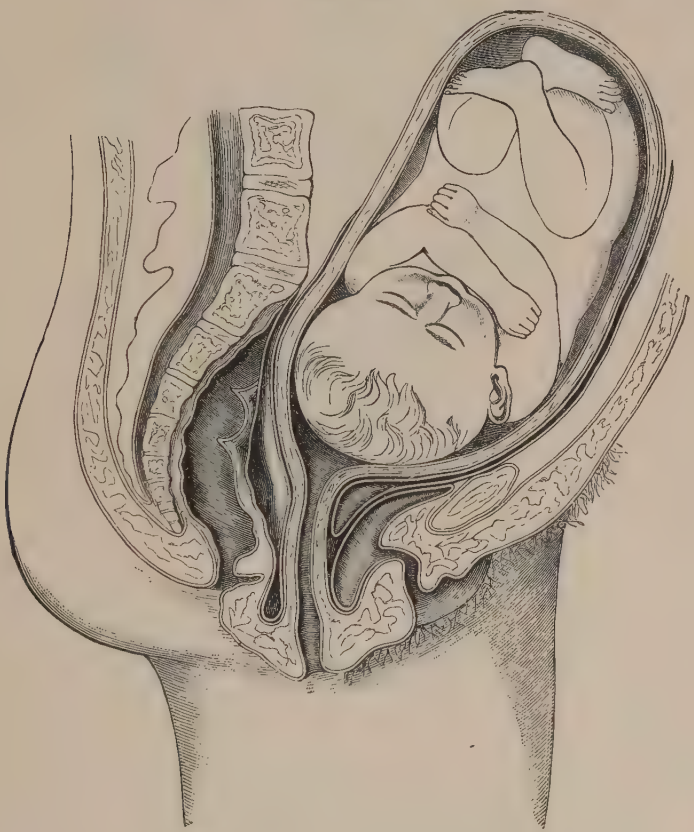
Rigidity of the Os. Under the different names of anatomical, simple, or mechanical rigidity of the os, a condition is met with, especially in old primiparæ, which causes great delay, and in rare cases presents an invincible obstacle to labor. The cervix has not been completely effaced, and the borders of the os are thick, resistant, hard, but not sensitive. In some instances the neck is hypertrophied, and in these it is not unusual to find, after labor has continued for some time, a thrombus involving the anterior or posterior lip. At first warm baths, warm vaginal douches, and a laudanum injection into the rectum may be tried, then artificial dilatation; Schröder advises incisions freely made by curved scissors or by a probe-pointed bistoury.

[1] Transactions of the American Gynecological Society, vol. v. p. 274.
[2] Medical and Surgical Reporter, 1877.

Remarkable results have been recorded by Farrar[1] as resulting from the application of a 10 per cent. solution of cocaine to a rigid os; it is probable that Dr. Farrar has made a most valuable addition to the means for treating this condition.

Dr. Robert Barnes, from whose work the subjoined illustration is taken, narrates a case in which the labor was impeded by a hypertrophied cervix: "A primipara, aged twenty-two, was in labor. The cervix protruded through the vulva about three inches, forming a mass equal to a man's wrist in circumference. After reducing the cervix in the vagina the head could be felt. The cervix had a hard, gristly feel. Free incisions in the os externum were made, so that the os externum was freely opened up to meet the natural expansion of the os internum. She was then delivered after an anxious labor of fifty-two hours."

FIG. 184.



ILLUSTRATING LABOR WITH HYPERTROPHIC ELONGATION OF THE CERVIX.

NEOPLASMS OF THE UTERUS. The injurious influence of uterine fibroids upon labor depends upon their size and their position. If the tumors are small, or subperitoneal, they may present no complication, and, indeed, may not be recognized in some cases until the labor is over.

[1] Transactions of the London Obstetrical Society for 1894.

Tumors of the neck, when large, prevent the presenting part from entering the pelvis; interstitial tumors of the body may be the cause of rupture of the uterus, or of post-partum hemorrhage, especially if the placenta be attached to the part of the uterine wall which they occupy. The relative proportion of fibroids of the neck to those of the body is much greater in pregnant than in non-pregnant women. Thus, while there are twenty cases in which these tumors are situated in the body to one where such a growth occupies the neck of the uterus in the non-pregnant, the proportion is only five to one in the pregnant, as ascertained by Chahbazian from the study of 310 cases of uterine fibroids complicating pregnancy.[1]

Chadwick[2] has reported ten cases of pregnancy and labor complicated with fibroids, with the following results: 1 miscarriage, 7 recoveries of mother and 7 living children, 2 deaths of mothers and 2 stillborn children. Fortunately in one-half of cervical fibroids observed in pregnancy or labor the tumors are pedunculated, 38 out of 76, according to Chahbazian's statistics. Another notable fact is that transverse and pelvic presentations are greatly increased, so that the two nearly equal the number of vertex presentations. In Chadwick's cases there were in 9 labors 7 head presentations and 2 transverse.

In the treatment of fibrous tumors of the uterus complicating labor, Lefour advises at first to wait, letting Nature accomplish all she can, but this delay must be determined by the interest of the mother and child. Next, act upon the tumor by its removal, or by pushing it up from the pelvis. Extirpation of the tumor was first performed by Michellacci in 1791.[3] The operation has been repeatedly done since, and with almost unvarying success as far as the mother is concerned, but with a very large fœtal mortality. As in a large proportion of cases the tumor is cervical, and as in one-half of these it is pedunculated (see Fig. 185), its removal will, under such circumstances, usually be neither difficult nor dangerous. If the tumor has no pedicle, it must be enucleated. But other tumors may occupy such a position that they cannot be removed, as, for example, a subperitoneal growth with a long pedicle that has dropped into the pelvis, or a tumor involving the neck and the lower part of the body of the uterus. Here an effort must be made to push it above the pelvic inlet. The patient is put in the knee-chest position, and the fingers or the entire hand introduced into the vagina and used to press the tumor out of the way; of course, pressure is made only in the intervals between contractions. If it is impossible either to extirpate the growth or to remove it from the pelvis, and space permit, the forceps or podalic version may be tried. The results from the former are very much more favorable than those given by version, and therefore it is to be preferred. In absolute narrowing of the pelvic cavity, Cæsarean section is indicated; the supra-vaginal amputation of the uterus, Porro's operation, may be done. If abdominal section is forbidden, embryotomy is the only resort; but while, of course, all the children are lost, it gives a fearful mortality for the

[1] Des Fibromes du Col de l'Utérus au point de vue de la Grossesse et de l'Accouchement.
[2] Boston Medical and Surgical Journal, July 30, 1885.
[3] See Chahbazian, op. cit.

mothers, 66 per cent. of them perishing. No one can hesitate, if the child is dead, in performing embryotomy, provided the mother does not run a greater risk than from abdominal section.

FIG. 185.

A POLYPUS OCCUPYING THE PELVIC CAVITY IN LABOR. (From RAMSBOTHAM.)

Cancer of the uterus gives a very unfavorable prognosis ; Cohnstein found that of 126 mothers only 54 survived, while 72 died during labor or in the puerperal period. If the disease partially affects only the lips of the uterus, labor may go on without special difficulties, and there may be no great hemorrhage. But if the entire cervix be affected, and especially if the disease has extended to the adjoining part of the body of the uterus, it is impossible for the diseased tissue to dilate, and the expulsion of the fœtus can only occur after rupture of the unyielding ring, which causes such a serious hemorrhage that may be difficult or impossible to arrest. Incisions of the cervix thus degenerated are dangerous because of consequent hemorrhage, and, according to Kleinwächter, because they must be carried through the entire wall and thus injure the peritoneum ; nevertheless, Charpentier advises them, and directs that they be followed by the application of the forceps. Hermann[1] states that " when labor has actually come on, expansion of the

[1] London Obstetrical Society's Transactions, vol. xx.

os uteri should be aided by making numerous small incisions in its circumference." He also says that when dilatation is in progress, if it is necessary to accelerate labor the forceps is preferable to version. When the disease, however, involves the entire cervix, the timely performance of the Cæsarean operation is generally considered as indicated, both in the interest of the mother and of the child.

Winckel, considering the large mortality of the Cæsarean operation in cancer of the uterus, and the great uncertainty of the child living, prefers perforation and extraction of the lessened fœtus through the vagina, thus securing to the mother, it may be, several months of life. He takes the ground that delivery of the lessened child is more humane. Certainly Winckel's advice deserves very serious consideration, though in this he is not in accordance with the majority of authorities.

Abdominal extirpation of the uterus in labor has been employed in a few cases, but the fatality of the operation is great. Vaginal removal a few weeks after labor has given good results, for the time at least.

Anomalies of Adjacent Organs. Chief among these which may interfere with labor are tumors of the ovary, the danger or difficulty

Fig. 186.

An Enlarged Ovary Blocking up the Pelvic Cavity in Labor. (From Ramsbotham.)

depending upon their size, position, mobility, and nature. Thus, an immobile, solid tumor in the pelvis is more serious than a fluid cystic tumor. Even if the tumor furnished no obstacle to the birth, there may

be, as Kleinwächter states, twisting of the pedicle during labor, and this be followed by rupture of the cyst in childbed, with fatal peritonitis. Dermoid cysts give a more unfavorable prognosis than those which are liquid, because they are fixed and their contents solid, so that they as a rule cannot be pushed out of the way nor their size lessened by puncture. Fibroid tumors of the ovary, especially if calcareous change has occurred, may cause great difficulty by descending into the pelvis in advance of the presenting part of the fœtus, and thus preventing its progress; on account of their hardness, it is very difficult when they have thus become fixed to distinguish them from pelvic exostoses.[1]

In disturbances of labor caused by ovarian tumors, reposition is the first thing; if this fails, puncture, usually by the vagina; if this is impossible, the Cæsarean operation.

Rectocele and Cystocele. Obstruction of the vagina from projection of the rectum loaded with feces, or of the bladder filled with

Fig. 187.

Cystocele Complicating Labor.

urine, can scarcely offer a serious hindrance to childbirth, especially if the obstetrician gives heed early in the labor to having each of these organs thoroughly evacuated. Ramsbotham, however, has stated that he has seen many instances of the bladder prolapsing before the head,

[1] Kleinwächter, op. cit.

and mentions two cases in which it was punctured, one practitioner mistaking it for a dropsical head, and the other for the bag of waters. Such errors can only result from culpable ignorance or carelessness.

Dr. Busey[1] is the author of a paper upon cystocolpocele complicating pregnancy and labor; by cystocolpocele is meant prolapse of the bladder into the vaginal passage; and if the sac occupies the cavity of the pelvis, filling the hollow of the sacrum, pushing the os uteri beyond reach, and occluding the vaginal passage, it is complete. One of the most marked results of this displacement of the bladder is lingering labor. The diagnosis is made by introducing the catheter into the bladder and evacuating it This displacement of the bladder in relation to pregnancy and labor was very fully considered by Broadbent, in 1863, in a paper read before the London Obstetrical Society. In referring to the diagnosis he states: "The prolapsed condition of the bladder is readily recognized on examination, especially when it contains urine in any considerable quantity. The cavity of the pelvis is found to be occupied by a bag of fluid, easily distinguished from the fœtal membranes by the fact that it springs from the pubis, and does not permit the finger to pass between it and the symphysis. As this sac, the bladder, fills up the hollow of the sacrum, the os uteri cannot be reached until the urine is evacuated; and if this is done by the catheter, the instrument can be felt from the vagina and followed to every part of the bladder. When the bladder is perfectly empty the displacement may be overlooked, but the finger, instead of circumscribing the lower segment of the uterus readily, meets anteriorly with the bladder, passing from the symphysis pubis to the uterus, and usually disposed in rugæ; the introduction of the catheter at once makes the case clear."

Whether called cystocele, prolapse of the bladder, or cystocolpocele, the obvious indication is to empty the organ and press it out of the way of the descent of the presenting part of the fœtus.

Vesical calculi have in very rare cases obstructed the birth-passage. It will generally be easy to push a tumor thus formed up out of the pelvis; if not, an opening may be made into the bladder from the vagina, and the stone or stones removed, after which sutures are to be introduced as in the operation for vesico-vaginal fistula.

The vagina may present an obstacle to labor from congenital or acquired circular stenosis, the former being very rare, or from cicatricial bands. Patient artificial dilatation, dividing bands with blunt-ended scissors or probe-pointed bistoury, will generally prove sufficient to secure delivery.

In rare cases a resisting hymen may be an obstruction; of course, incisions remove the resistance.

Still rarer are the cases in which vaginismus prevents delivery; Benneke saw such a case, in which even craniotomy was necessary (Kaltenbach); usually the difficulty is overcome by deep anæsthesia.

[1] Transactions of the American Gynecological Society, vol. xii.

CHAPTER VII.

ANOMALIES OF THE PELVIS.

ANOMALIES of the pelvis may be conveniently divided into those of position, of size, and of form.

The first division includes two varieties. The pelvis has a normal inclination or obliquity, and the deviations from this obliquity may be by excess or by defect; that is, the inclination may be increased or lessened.

So, too, the second division includes two classes: 1, that in which the pelvis undergoes uniform increase, *pelvis æquabiliter justo-major;* and, 2, that in which similar decrease occurs, *pelvis æquabiliter justo-minor.* The latter is described as a pelvis uniformly contracted; in order that a pelvis may be called contracted the true conjugate must be lessened one centimetre and a quarter, but if there be a uniform lessening of all the diameters one centimetre, or about four-tenths of an inch, then general contraction is said to be present.

The third division includes those characterized by change in the pelvic form; in the second class there are simply changes in size, the pelvis remaining symmetrical, but in this it becomes asymmetrical—its form perverted, or the pelvis is said to be deformed, and, so far as the injurious results in relation to labor are concerned, vitiated. Such deviations from the normal may involve the vertical diameters with reference to the transverse, or the latter with regard to each other, and these constitute the chief ones to be considered. The last presents three classes: 1, that in which the antero-posterior diameter is lessened; 2, the transverse diameter is lessened; and, 3, the diminution is in the oblique diameter.

These various pelvic anomalies will now be considered in the order that has been given.

1. *Anomalies of Position.* As already stated, deviations from the normal obliquity of the pelvis are two; this obliquity may be increased or lessened.

Lobstein,[1] in an unpublished memoir presented to the Society of Medicine of the Faculty of Paris, 1817, first directed the attention of obstetricians to the consequences of too great or too slight inclination of the pelvis. The anterior obliquity may be so exaggerated that the axis of the inlet is horizontal. Moreau narrates a case in which the plane of the inlet was vertical, and there was also associated with this vicious inclination of the pelvis narrowing from rickets, which compelled the Cæsarean operation. Naegele has described the case of a married woman in whom the inferior strait was turned directly behind; the pubic symphysis and the upper part of the sacrum were directed horizontally, and consequently the plane of the superior strait was vertical; the venereal act never took place but in a position opposite to the natural one. She became

[1] Dictionnaire Encyclopédique des Sciences médicales, t. viii.

pregnant, but the pelvis being normal no difficulty occurred at labor; six other consecutive pregnancies occurred, and ended with the same facility as the first.

By so-called posterior obliquity—a true obliquity in a backward direction of course is impossible—is generally understood a marked lessening of the normal obliquity, that may go to such extreme that the plane of the inlet becomes horizontal. This obliquity is usually associated with deformed pelvis, but it has been observed independently of such vitiation.

In cases of posterior obliquity or pelvic retroversion "the vulva is directed much more in front than usual, and the pubic symphysis presents a direction more or less approaching the vertical. The superior half of the sacrum has become parallel to the axis of the trunk, and the lumbar region is more or less without its posterior concavity—a flat back. Finally, the point of the coccyx is always found in the vertical position either at the level or beneath the summit of the pubic arch, and the last false rib is generally nearer the iliac crest than in the normal state."

In addition to these obliquities, Lenoir has given a description of lateral obliquity of the pelvis. According to Depaul, lateral obliquities are very frequently found in connection with rhachitic skeletons, and even in cases of shortening, atrophy, or old luxations of the abdominal members.

Naegele, in referring to inclination of the pelvis, makes the following remarks: "Even when this inclination is normal, it quite often happens in cephalic presentation that the head presses upon the superior border of the pubic symphysis, and thus to some degree its entrance into the pelvic cavity is retarded. If in such cases the other conditions of the mechanism of labor are normal, this resistance is overcome soon by the efforts of nature, and delivery is accomplished without special difficulty. But if at the same time there is a more or less great disproportion between the head and the basin, the resistance presented by the anterior wall of the latter exerts a very injurious influence. This influence is much worse still when at the same time the inclination of the pelvis is too great. If, as frequently happens, an inclination exceptionally great coincides with narrowing of the pelvis, obstetric operations may be rendered much more difficult. For this reason it appears necessary in all cases where the head of the fœtus strikes against the pubic symphysis at entering the pelvis to have the woman lie in such a way that the lumbar vertebræ may be strongly flexed; that is to say, give her a half-sitting posture by raising the hips and the upper part of the trunk, or have her lie upon the side, her back bent forward, and the thighs strongly flexed upon the pelvis."

2. *Anomalies of Size.* This division, which includes uniform increase and uniform lessening of the size of the pelvis, might also be distinguished as symmetrical anomalies in contradistinction to the third class, in which the anomalies are chiefly asymmetric.

The illustration, Fig. 188, taken from Depaul, represents the justo-major and the justo-minor pelvis, while the line marked B is the measure of the distance between the iliac crests in a normal pelvis.

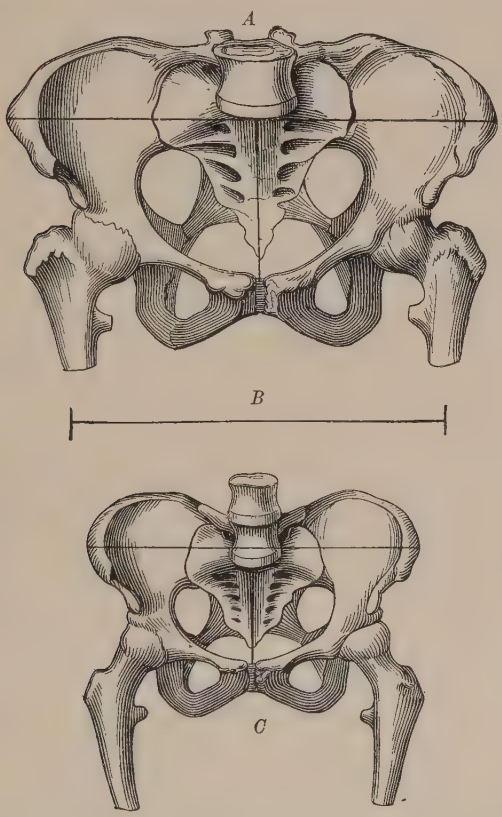
a. The justo-major pelvis. In the pelvis marked A the distance between the antero-superior spinous processes was 28 centimetres, more than 11 inches, and that between the iliac crests 32 centimetres, more than 12 inches. The antero-posterior diameter of the inlet was 13 centimetres (5 inches), the transverse 16 centimetres (6.3 inches), and the oblique 15 centimetres (5.9 inches). The justo-major pelvis has been justly compared to the pelvis of a giantess found in a woman of ordinary size.

Schröder taught that the generally enlarged pelvis did not disturb

the course of labor, causing this to be rapid, and, in short, that it should not be regarded as pathological unless the same conditions were present, as might be observed in the case of a normal pelvis. On the other hand, most obstetricians believe that such a pelvis contributes to precipitate birth by the ampler bony canal through which the fœtus is transmitted.

b. The pelvis justo-minor, or the generally-contracted pelvis. This pelvis, as has been before stated, is characterized by a uniform lessening of its diameters; it is one of the most important anomalies of the pelvis.

FIG. 188.



A. Justo-major pelvis. B. Normal distance between the iliac crests. C. Justo-minor pelvis.

At least three varieties of this pelvis have been described. In the first the pelvis has the form characteristic of the sex, but seems to have been arrested in its development; the bones are frailer and smaller, and, though it is usually found in women whose stature is under the normal, it may also sometimes belong to tall women who are with this exception perfectly developed. While in another variety to be mentioned there usually is a departure from the strict definition of the justo-minor pelvis—uniform lessening of the pelvic measurements—this corresponds

quite accurately. The second variety, the dwarf's pelvis, presents the usual characteristics of the normal female pelvis, only it is under size; there is a correspondence between the pelvis and the height, and the bones of the former correspond in their development as to size and firmness with those of the rest of the skeleton. The third variety is the masculine pelvis. This may have the external form of the female pelvis, but in some very strongly resembles the male. The bones are thick and strong; the sacrum is narrow; the ilia are straighter than normal; and the ischia are nearer each other. The external measurements may vary but slightly from the normal, and the contraction may not be uniform, but may concern the inlet, the cavity, or the outlet; in the latter case the pelvis becomes funnel-shaped.

The equally-contracted pelvis is not frequently seen; of its three varieties the masculine basin is the least, the dwarf's the most rare.

The causes of the justo-minor pelvis are generally obscure. In some instances the anomaly may result from rickets. This origin has been generally accepted. Zweifel states that he has seen one typical instance of generally equally contracted pelvis which was caused by rickets, though this disease usually produces another abnormal form. Müller has mentioned the frequency of this pelvis in crétins and semicrétins. Still, there remain the great majority of cases of this partial pelvic development which cannot be attributed to any constitutional disease either hereditary or acquired.

Before giving the diagnosis of the generally-contracted pelvis, studying the mechanism of labor in such pelves, and the treatment of labor there occurring, it is necessary first to consider the means by which deformities of the pelvis are known—a subject the importance of which cannot be exaggerated.

Kleinwächter observes, no error in diagnosis is so terribly avenged upon the mother and the child as one relating to contracted pelvis.

It might be added that the vengeance falls, too, upon the obstetrician, for he can never escape self-reproach if, suitable opportunity having been his, he has failed to recognize the deformity in time to ward off at least some of its consequences, or possibly saving both mother and child by means appropriate to the emergency. A primigravida, for example, is in labor at the normal end of pregnancy; her form is apparently perfect, her health excellent, and there is not the least suspicion that the pelvis is abnormal. The first period of labor is somewhat longer than usual; the second is protracted until instrumental interference is demanded in her interest, if not in that of the child. One or more consultants come, and the forceps is tried, first one pattern, and then another, but all in vain, Meantime, serious inroads upon the patient's strength have been made, and disappointment at the delay in delivery almost brings her to despair. The next step is a craniotomy, the attendants now fully convinced that it is impossible for a living child to pass through the narrowed inlet. But before craniotomy and extraction of the mutilated fœtus can be completed she dies. Examination of the pelvis after death proves that the antero-posterior diameter of the inlet is barely two inches and a half. A timely Cæsarean operation would probably have saved both mother and child, or, this being refused, the mother's salvation might have been secured if the embryotomy had not been deferred until she was exhausted.

Diagnosis of Pelvic Anomalies. This is made by the recognition and appreciation of signs which may be classified as probable and certain. The former are ascertained from the history of the patient, from her general appearance, carriage, walk, stature, etc., while the

latter are sought by direct examination of the pelvis. In the history we learn as to sickness during infancy and childhood; as to the period when walking began; whether there was any bodily deformity observed at birth or any manifested since; whether any injury to the pelvic joints or dislocation of one of the femurs occurred in early life or in adolescence; whether one hip is higher than the other, or either femur is ankylosed. The vertebral column is examined for deformity, whether apparent or latent; if it presents a deforming curvature, the period of its first manifestation is inquired for, such curvature, if appearing in infancy, was most probably caused by rickets; and this origin will be confirmed by finding the lower limbs notably curved. In this case the pelvis is in almost all cases deformed. But if the spinal curvature began during adolescence, the cause is not rickets and the pelvis may be normal. The woman is lame, the first manifestation and cause of that lameness should be ascertained.[1]

If the woman has previously been delivered, we inquire as to whether the labor was natural or artificial, whether the child was born living or dead, and in case of instrumental delivery what means were employed. If possible, too, ascertain further as to the cause of the difficulty in the previous labor or labors, for that may have been from an abnormal presentation or from excessive size of the child. It should also be remembered, on the other hand, that though the first labor may have been spontaneous, there might still be some narrowing of the pelvis, which would render subsequent ones difficult from the increasing size of the children.

Certain Signs. As before stated, the positive proofs of pelvic deformities are obtained by measurements of the pelvis, or pelvimetry. These measurements are made by an instrument called a pelvimeter, by an ordinary tape-measure, and by the hand or fingers. The pelvimeter most generally employed is that of Baudelocque or that of Martin; the latter instrument has the recommendation of being quite portable, and is represented in use in Fig. 189. In using the pelvimeter the woman should be lying upon her back, and the lower portion of the body exposed, or at least covered with only one thickness of very thin material. Before beginning to measure, the obstetrician applies his hands externally to the pelvis, ascertaining whether one hip is higher[2] than the other, finds out whether there is decided narrowing of the hips, the thickness and size of the iliac bones, the

[1] Peu, La Pratique des Accouchemens, Paris, 1695, makes the following statement, which is interesting as one of the earlier obstetric references to deformed pelvis, and as also showing that this wise observer could not be beguiled by beauty, intellect, wealth, and social position into marrying a young lady whom he believed, from her lameness, had a deformed pelvis: "I remember that at the time of the second Paris war, having recently settled, it was proposed to me to marry a beautiful young lady, rich, very spirituelle, and one whose father I greatly honored; but she was small and lame in one lower limb. The consequences of the lameness which I apprehended prevented me from making this alliance. One of our aspirants in surgery, braver than I, or perhaps more unfortunate, fell in love with her and married her. Unfortunately, she became pregnant. Shortly her abdomen touched the ground, and she fell from the slightest misstep. Her frequent falls compelled her to lie in bed. Her child died, and she also when about eight months pregnant."

Further reference to lameness as indicating deformity is given by Dionis, Traite général des Accouchemens, 1718. He has remarked that "the lame who have one of the hip-bones higher than the other sometimes have great difficulty in labor, because the basin formed by these bones is not exactly round, and the infant is obliged to redouble its efforts in order to go through the passage."

[2] Want of symmetry in this respect is so common as to be the rule, and it is only a marked deviation that should awaken the suspicion of the examiner.

depth of each iliac fossa, the breadth and curvature of the sacrum, and the height of the pubic joint. Next the external measurements are made: first, the distance between the anterior superior spinous processes of the iliac bones, one of the knobs of the pelvimeter touching the one processs, and the other placed upon that of the opposite side; this is usually 25 centimetres, or about ten inches; second, the greatest distance between the iliac crests at their external margin is similarly ascertained; this diameter is 28 centimetres, or 11 inches.[1] The third measurement made is that between the great trochanters; this, in case of a normal pelvis, is 31 centimetres, or 12¼ inches. If these three diameters are normal, we know that there is no lateral narrowing of the pelvis. The fourth measurement is taken from the spinous process of the last lumbar vertebra to the middle of the anterior surface of the pubic joint. This diameter, known as the external conjugate or the diameter of Baudelocque, enables us to approximate the probable antero-posterior diameter of the pelvic inlet, or the true conjugate; the former measures 20 centimetres (7.9 inches), and by deducting from it 8 centimetres[2] (3.1 inches) the latter is approximately ascertained; such deduction is supposed to correspond with the combined thickness of the pelvic walls, anteriorly and posteriorly. But the only absolutely certain fact which we reach by measuring this diameter is, that if the distance be notably diminished the true conjugate is less than normal.[3]

Litzmann asserts that sometimes the measurement of the distance between the posterior-superior iliac spines may be useful in the diagnosis of the form of the pelvis. The relation between this and the distance between the antero-superior iliac spines varies in the normal and in the uniformly contracted pelvis between 1 to 3 and to 3.3; in the flat rhachitic pelves, 1 to 3.5; in rhachitic flat and generally-contracted pelves, 1 to 3.9; and in the simply flat rhachitic pelves, 1 to 4.3.

The diagonal diameters extend from the postero-superior iliac spines to the antero-superior spines, passing from the right to the left, and from the left to the right; if the pelvis be symmetrical they are equal, or the difference is very small. They are each about 22.5 centimetres, and if normal indicate that the corresponding diameters of the inlet are also normal.

Löhlein has sought to learn the transverse diameter by measuring from the inferior margin of the subpubic ligament to the upper angle of the sciatic notch and adding to it 20 mm. While this method gives a correct result in the normal, it is without value in the abnormal pelvis.

In the great majority of cases the obstetrician will be content with measuring the distances between the iliac crests and the antero-superior iliac spines, and the external conjugate, so far as external pelvimetry is concerned. Pershing, in a valuable paper[4] published a few years ago, after urging the importance of examining the pelvis of every pregnant woman, adds: "The examination should consist in measurement of the external conjugate, and anterior and posterior iliac spines, and iliac crests. If these external measurements indicate a normal pelvis, the examination may end with them. But if contraction is suspected,

[1] Litzmann, Die Geburt bei Engen Becken, states that in 200 women with a large pelvis, he found these measurements 27 and 29. 5 centimetres. Winckel states them to be 26 and 28, while Zweifel gives the numbers in the text.

[2] Litzmann states, op. cit., that in 30 cases in which he had an opportunity of comparing the external conjugate measured upon the living with the true conjugate measured upon the cadaver or upon the dried pelvis, he found a mean difference of 9.5 centimetres, with a maximum of 12.5 and minimum of 7 centimetres.

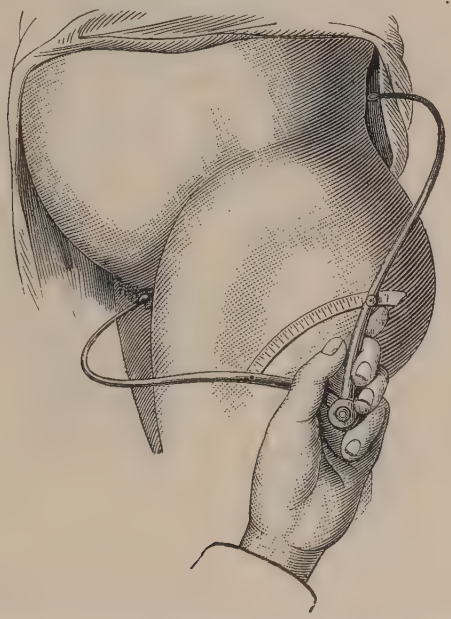
[3] If the external conjugate measures less than 16 centimetres the pelvis is always narrowed antero-posteriorly; if below 19 centimetres there is narrowing in one-half the cases, between 19 and 21.5 scarcely once in ten, and above 21.5 almost never. (Litzmann.)

[4] Pelvic Measurements and their Importance in Obstetric Practice, American Journal of the Medical Sciences, February, 1889.

the diagonal conjugate and oblique ascending diameter of Löhlein should also be taken."

The circumference of the upper or false pelvis is formed by applying the end of an ordinary tape-measure to the spinous process of the last lumbar vertebra, and carrying the tape along the iliac crest of one side, and thence to the median line at the pubic joint; similarly, the other half is measured, the results added, and thus the entire circumference is ascertained. Evidently, if the one measurement is greater than the other, the pelvis is asymmetrical. The normal circumference of the false pelvis is 90 centimetres = 35.5 inches.

FIG. 189.

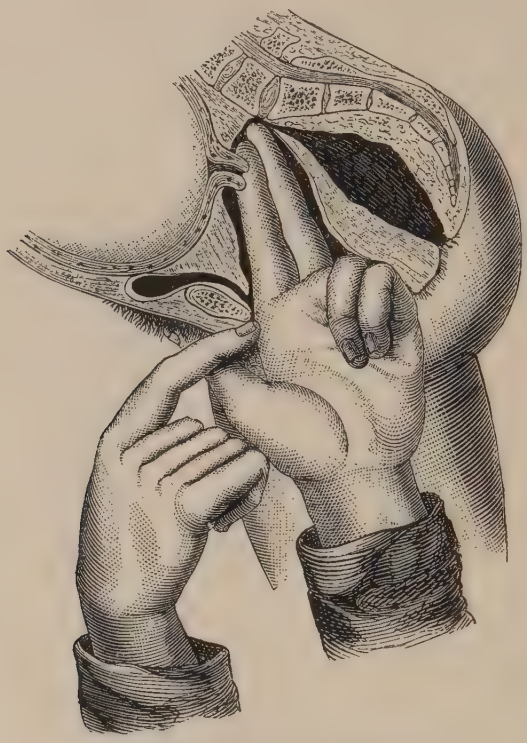


MEASURING THE EXTERNAL CONJUGATE WITH MARTIN'S PELVIMETER.

Next, the diagonal conjugate—that is, the distance from the lower margin of the pubic joint to the promontory of the sacrum—is found usually by means of one or two fingers. In the following illustration the index and medius of the left hand are extended, the thumb abducted, and the third and fourth fingers folded upon the palm; the extended fingers are carried up and backward in the pelvic cavity until the promontory is touched; then, still keeping up this contact, the hand is brought upward until its lateral margin, just below the index finger comes in contact with the subpubic ligament. Next, this last point is marked by the nail of the index finger of the right hand; then the left hand is withdrawn, and the measurement made from this mark to the tip of the finger. Kleinwächter holds that the introduction of the index and medius at the same time ought not to be permitted,

except perhaps in the case of a multigravida, because the stretching of the soft parts by two fingers will cause pain; but he adds that in very difficult cases the half or the whole hand may be used. There is difficulty in reaching the promontory if the pelvis is normal, but, of course, it is more accessible as the true conjugate is lessened.

Fig. 190.



Measuring the Diagonal Conjugate.

If the basin be normal, the true conjugate may be found by subtracting 15–16 millimetres ($\frac{5}{10}$ - $\frac{6}{10}$ of an inch) from the diagonal conjugate. "It is evident that this subtraction will vary according to the angle which the true conjugate makes with the pubic symphysis, and as to the height of the symphysis. It is increased with the obtuseness of the angle and with the elevation of the symphysis. Hence, with the various pelvic deformities the subtraction will vary. Though the height and thickness of the symphysis may be ascertained, but not the angle which it forms with the true conjugate, the latter can only be estimated, and hence slight errors may be made. Nevertheless, with proper skill the length of the true conjugate may be determined within a few millimetres, and the error is so slight that it may be regarded as of no importance."

Measurements of the diameters of the pelvic outlet are of much less importance; nevertheless, they may be required in some cases. To obtain the antero-

posterior diameter, the woman lies, for example, upon her left side, and the obstetrician with the thumb and index finger of the right hand—the former externally, the latter in the vagina—finds the sacro-coccygeal joint, and includes it between them. The end of the finger is fixed at that point, while the body of the finger is carried forward and upward until its lateral surface is brought against the subpubic ligament, and while held firmly in that position is marked by the nail of the index finger of the other hand, as in ascertaining the diagonal conjugate. Upon withdrawing the finger the distance from the mark to the tip is measured, and this will give the desired diameter. Breisky places one of the knobs of the pelvimeter externally at the sacro-coccygeal joint, while the other is put at the lower margin of the pubic joint; now subtract from the measure thus obtained 1 to 1.5 centimetres, and we then have the antero-posterior diameter. Breisky recommends for measuring the transverse diameter of the pelvic outlet Osiander's pelvimeter. The knobs are placed upon the ischial tuberosities, and from the measure thus obtained of the intervening distance between the tuberosities, 1–2 centimetres must be subtracted for the thickness of the soft parts. Frankenhäuser's method is to place the thumbs, their nails being directly opposite, upon the most prominent surface of the inner margin of the ischial tuberosities, and then with Osiander's pelvimeter measure the distance between the nails.

Barbour[1] states that the transverse diameter of the outlet is best estimated by Chantreuil's method: "Place the patient in the genu-pectoral position or in that of lithotomy, though the former facilitates the measuring; pass the index fingers into the vagina, and turn them back to back so that the pulp of the finger rests on the inner surface of the ischial tuberosities; an assistant lays the points of the calipers on the palmar surface of the fingers just outside the vulva, the distance intervening corresponds to the inside measurement between the tuberosities. This allows us to use the ordinary calipers."

Diagnosis of the Justo-minor Pelvis. The distances between the iliac anterior superior spinous processes and between the iliac crests are found less than normal in all cases, an exception being made for the masculine pelvis, for in it, in consequence of the increased thickness of the bones, these differences may be very slight or even absent. The pelvic circumference is lessened, as is also the true conjugate. Contraction at the outlet will be suggested by the apparent approximation of the ischial tuberosities and spines, and be confirmed by ascertaining that the antero-posterior and the transverse diameters are under the normal.

Labor and its Treatment in the Generally-contracted Pelvis.[2] Labor begins with the fœtal head at the pelvic inlet, for there is not, as there is in the majority of primigravidæ[3] having a normal pelvis, descent of the head into the pelvic cavity during the last weeks of pregnancy. The resistance of the lessened inlet compels strong flexion of the head upon the chest, and thus, with the occiput below, the head enters, the biparietal diameter corresponding with the conjugate, and the suboccipito-bregmatic with the transverse; the sagittal suture is at first usually in the transverse diameter. The uniformity of the pelvic contraction shows itself by the strong resistance to any less-

[1] Spinal Deformity in Relation to Obstetrics.

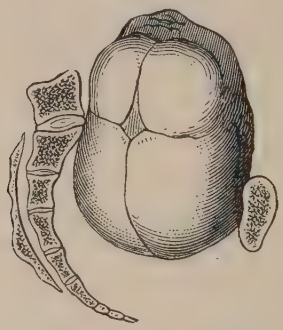
[2] Litzmann, in considering the question what should be understood by a contracted pelvis, states that for the simply flat pelvis, and perhaps also for the generally-contracted flat pelvis, shortening of the true conjugate to about 9.7 centimetres constitutes the boundary line between the contracted pelvis and the pelvis of normal size, while for the pelvis uniformly contracted the limit of the true conjugate is 10 centimetres.

[3] Litzmann found partial entrance of the head in 8.1 per cent. at the end of pregnancy, and that in scarcely one-fourth of the cases after labor had begun did descent of the head occur before rupture of the bag of waters.

ening of flexion, there being such constant and great pressure upon the frontal arm of the head-lever.

Zweifel, in describing the mechanism of labor in generally-contracted pelves, says the sagittal suture may sometimes be in the transverse or in the oblique, or even in the antero-posterior, pelvic diameter, and hence the child's head becomes elongated. This elongation, however, cannot be in the occipito-mental diameter, but rather in that described by Budin as the maximum diameter, for the squamous portion of the occipital bone is pushed under the parietal bones, this movement being permitted by the cartilaginous connection between it and the basilar portion. So, too, the equally strong compression to which the head is subjected on all sides compels overriding of the frontal by the parietal bones, while the posterior of the latter overrides the anterior. The caput succedaneum is large and long, even in some cases protruding from the vulval opening while the head is in the cavity.

FIG. 191.



MARKED FLEXION OF THE HEAD ENTERING A GENERALLY-CONTRACTED PELVIS.

The duration of labor is about one-third longer than if the pelvis is normal. From the head remaining so long at the pelvic brim while strong uterine contractions are going on, there is danger of injury to some portions of the lower uterine segment, resulting in subsequent inflammation, or actual perforation caused by long-continued attrition. So, too, exhaustion may come on to such degree that the life of the mother is imperilled, the uterus falling into a state of atony. The long continuance of the labor carries danger to the fœtus, and injury may also result from the strong compression of its head.

Delay in rupture of the membranes until the os is fully dilated, descent of the occiput rather than of any other part of the fœtus, moderate size of the fœtus, yielding character of the bones of the head, and on the part of the mother a slight degree of pelvic contraction and vigorous uterine and voluntary action, have been correctly stated to be propitious, the labor under these circumstances usually terminating favorably for both mother and child.

On the other hand, early rupture of the membranes, great size of the child, unyielding nature of the cranial bones, and unfavorable presentation—as, for example, of the pelvis (usually a knee or foot descends

first because of the difficulty of the pelvis entering the inlet), of the brow, or a shoulder—make the prognosis unfavorable.

The mortality of children Litzmann states is 9.5, and that of mothers a little more than 6 per cent.

The forceps[1] is not applicable in general contraction of the pelvis until the head is completely moulded. So, too, podalic version is not indicated if the head presents, for extraction after turning cannot be effected soon enough to save the child's life; the head must be moulded to the passage in a few minutes—a process which Nature's forces require hours to accomplish. Further, if craniotomy should finally become necessary, the difficulties of the operation are increased because of the head coming last. Another objection to delivery by podalic version is the danger of ascension of the arms in consequence of the pelvic contraction. In those cases in which the contraction is chiefly at the inlet the mechanism of labor after the head has entered the cavity is the same as in a normal pelvis, and the treatment also corresponds.

3. *Anomalies of the pelvic form or asymmetrical changes in the pelvis.* Two divisions of this class are made, the first including changes in the depth of the pelvis:

a. That in which the vertical diameters of the pelvis are increased, without a corresponding change in the horizontal. Such change increases the depth of the pelvis, but, alone, does not to an important degree modify the course of the labor; the latter will be longer, and in some cases its protraction may require the use of the forceps.

b. The second class embraces those pelves whose depth is lessened. But this change is in almost all instances associated with what are commonly called pelvic deformities. If occurring independently, all the horizontal diameters being normal, other conditions being favorable, the duration of labor is shortened.

The second division is much more important, and includes those changes which deform, render asymmetrical, or vitiate the pelvis. It embraces three varieties: 1, those characterized chiefly by shortening of the antero-posterior diameter; 2, a like change in the transverse; and, 3, the same in the oblique diameter.

The following subdivisions are made of these three classes of pelvic deformities. These subdivisions are those adopted by Zweifel:

I. Pelves chiefly contracted in the antero-posterior diameter:

a. The flat pelvis;
b. The rhachitic flat pelvis;
c. The generally-contracted flat pelvis;
d. The spondylolisthetic pelvis;
e. The pelvis flattened by double luxation;
f. The lumbo-lordotic pelvis.

The last originates in lordosis of the lumbar vertebræ, which is compensated by a deeply situated kyphosis. In consequence of the lordosis the lumbar vertebræ may project over the pelvic entrance, causing the deformity known as pelvic obtecta, or roofed pelvis. In the osteomalacic pelvis, to be described in the next class, there is also considerable contraction in the antero-posterior diameter:

[1] Kleinwächter.

II. Pelves chiefly contracted in the transverse diameter:
   a. The osteomalacic pelvis;
   b. The ankylotic transversely contracted pelvis;
   c. The kyphotic transversely contracted pelvis.

In *b* and *c* the narrowing is only in the pelvic outlet.

III. Pelves chiefly contracted in their oblique diameter:
   a. The ankylotic obliquely contracted pelvis;
   b. The coxalgic pelvis;
   c. The scoliotic pelvis.

Neoplasms originating in the pelvic walls constitute a final class of pelvic deformities.

The Simple Flat Pelvis. This pelvis may be found in women who present no other anomaly of form which would awaken the slightest suspicion of its presence. They are usually of normal stature and apparently of perfect development. There is no history of disease of the bones in infancy or childhood, or of injury to spine or pelvis or lower limbs in adolescence. How often has this anomaly led to the most deplorable results in childbirth! Even in Europe this pelvis is found a little more frequently than the rhachitic, while the American obstetrician will meet with it oftener than any other pelvic anomaly, and thus forewarned ought to be forearmed.

The cause of the deformity is not clear. The deformity consists essentially in an approximation of the sacral promontory to the anterior pelvic wall, and the sinking of the sacrum has been attributed to walking too early, to sitting too long at a time in infancy, and also simply to the weight of the body, when neither of the other causes can be justly adduced. Still another explanation of the etiology has been suggested—the carrying of heavy weights in childhood; but the occurrence of the anomaly in women who were never subjected in childhood to severe toil renders necessary the explanation that has been given—viz., the simple weight of the body may cause the deformity.

The descent of the sacrum is without any rotation upon its transverse axis, and the approximation of this bone to the pubic bones, and the shortening, involve only the antero-posterior diameter of the inlet, or if those of the cavity and outlet are lessened the diminution is very slight. The descent causes strong tension upon the ilio-sacral ligaments, which would result in separation of the iliac bones if it were not for the resistance of the pubic joint; and the consequence is that the transverse diameter undergoes slight increase and the pubic joint is brought nearer the sacrum.

Schröder states that in very rare cases a flattened pelvis is also narrowed in the transverse diameter of the outlet. In a practical point of view, this is a very important complication of the flattened pelvis, sometimes the articulation of the first with the second sacral vertebra, which remains unossified, forms that which is called a double promontory; that is to say, the two vertebræ meet at an obtuse angle posteriorly, and the articulation makes in contracting a projection in the pelvic cavity.[1] If a line be drawn from this projection to the pubic

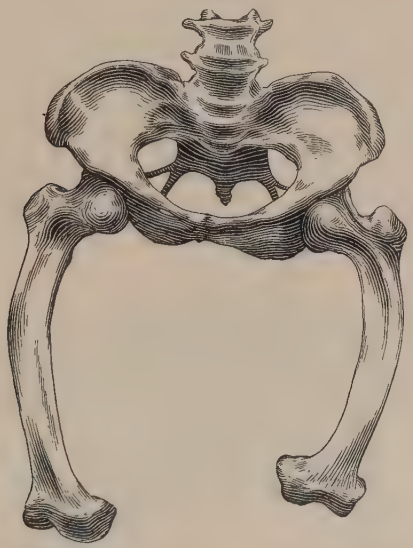
[1] Schröder. Nevertheless, Zweifel remarks in reference to the name given this pelvis, that we use the expression simple, *einfach*, in contradistinction to rhachitic. By this term Michaelis first expressed the difference between the single and double promontory.

symphysis, it is as short as, or even shorter than, the true conjugate itself, and, as this anomaly has an essential obstetric importance, it must be included in pelvic measurements.

The diagnosis of the flat, non-rhachitic pelvis is readily made by measuring. The transverse measurements are normal or slightly increased; the circumference is normal or slightly decreased, but the two sides of the upper pelvis are symmetrical; the external conjugate is always diminished, and by this diminution, combined with that of the diagonal conjugate, the true conjugate is found, which, of course, is less than normal, and in the great majority of cases at least 8 centimetres (3.1 inches).

Rhachitic Flat Pelvis. This deformity results from pressure upon the base of the sacrum chiefly, causing not only descent of the bone, but also a partial anterior rotation upon its transverse axis; thus the promontory is brought nearer the pubic joint, and the true conjugate necessarily shortened. In a flat rhachitic pelvis in the Museum of

Fig. 192.



Flat Rhachitic Pelvis (Mütter Museum, College of Physicians, Philadelphia).

Jefferson Medical College I find the following measurements of the pelvic inlet: Oblique diameter, 5 inches; transverse, $5\frac{1}{2}$ inches; and true conjugate, 3 inches. The measurements of the outlet are: antero-posterior, $3\frac{3}{4}$ inches, and the transverse 4 inches. The depth of the pelvis at the pubic joint is $1\frac{1}{4}$ inch, at the sides $2\frac{3}{4}$ inches.

Rickets is a disease occurring in infancy or early childhood, chiefly characterized by a disorder of nutrition and development of bony tissue, the disorder involving various deformities of the skeleton, swelling of the epiphysis, bending or fractures of the diaphysis, important changes in the shape of the pelvis, and frequently curvatures of the spine. While in almost all cases it is a disease of extra-uterine life, yet there have been instances in which it occurred *in utero*, probably the first recorded one being given by Glisson in 1650.

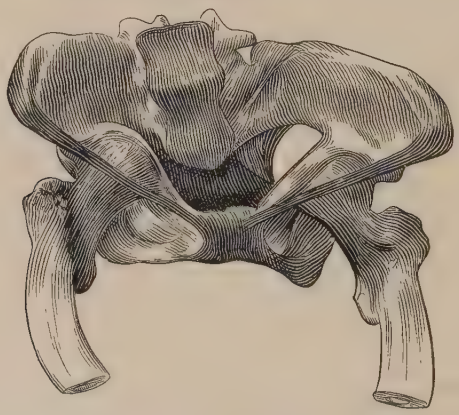
It is a disease especially of poverty, and is found most frequently in the large cities of the Old World, where the poor abound and the children of the poor often so greatly suffer from want of sufficient food, fresh air and sunshine, and proper clothing. Arnott[1] speaks of its being frequent in India, though he also states that, so far as his experience goes, osteomalacia is, relatively to rickets and also absolutely, more common in India than in Europe.

The child suffering from rickets does not walk so early as healthy children, but is much of the time in a sitting posture; the pressure of the body's weight causes not only the changes in the position of the sacrum previously stated, but also, through the resisting tension of the ilio-sacral ligaments, drawing of the innominate bones, so that they would separate if it were not for the resisting pubic joint; this separation being impossible, the bones yield, and hence the transverse diameter of the inlet is increased, "just as a long bone may be fractured in the shaft by a force applied at one end, the other end resisting." In consequence of the weight of the body resting upon the ischial tuberosities, and by the action of muscular traction, the former are more widely separated, and also the pubic rami, and the pubic arch is broadened.

If the child walks during the disease, the pelvic deformity is greatly increased, there being superadded the changes caused by pressure upon the acetabula. "The parts adjacent to the acetabula are pressed into the basin by the resistance of the heads of the femurs, and thus the sacro-cotyloid diameters are lessened. In consequence of the approach of the ilio-pubic tubercles the ischial spines are pressed in the pelvis; the approximation of the former causes a beaked protrusion of the pubic joint." In the highest degree of the deformity the lumen of the pelvis is almost closed, and with bending of the sacrum and iliac bones the pelvis may take a triangular form and is known as the pelvis triloba, or the pseudo-osteomalacic pelvis.

Turning from these graver deformities of the pelvis caused by rickets, we will now consider the diagnosis of the simply flat rhachitic pelvis. The history of rickets is learned, and many of its obvious consequences

FIG. 193.



PSEUDO-OSTEOMALACIC PELVIS (Mütter Museum, College of Physicians, Philadelphia).

in other parts of the pelvis may be present. The distance between the antero-superior iliac spines is equal to, possibly exceeds, that between the iliac crests; the external conjugate is always lessened; the true conjugate is shortened; in some instances the second sacral bone protrudes into the pelvic cavity, making what is called the false promontory, and

[1] Transactions of the Edinburgh Obstetrical Society, vol. x.

this may be more prominent than the true, when, of course, it becomes one of the terminal points of the conjugata vera. The antero-posterior and transverse diameters of the outlet are unusually large in comparison with the contraction at the inlet.

The Mechanism of Labor in the Simple Flat and in the Rhachitic Flat Pelvis. In consequence of the narrowing of the pelvic inlet, the head of the fœtus not only does not enter the pelvic cavity, as is the rule in the last weeks of pregnancy in primigravidæ, but it may be turned aside at the brim, and hence the proportion of transverse presentations is increased. Another factor[1] in causing such malposition of the fœtus is found in multigravidæ in the relaxed abdominal and uterine walls, which permit anterior displacement of the uterus, though a pendulous abdomen, as Litzmann observes, is especially frequent in pelvic contraction, and in these cases there is not simple anteversion, but anteflexion of the uterus. If the pelvis be below, its descent through the narrowed aperture does not occur, but the feet are prone to enter. Supposing the head to be at the inlet when labor begins, it, as a rule, takes a transverse position; that is, the sagittal suture instead of being oblique lies directly from one side toward the other of the pelvis. Resistance to the descent of the occiput compels a partial deflection, and the anterior and posterior fontanelles may be in the same pelvic plane; thus the transverse diameter of the fœtal head is in the pelvic conjugate, and the occipito-frontal in the pelvic transverse. But in this accommodation the anterior parietal is somewhat in advance of the posterior, and therefore the sagittal suture approaches the sacral promontory. (See Fig. 194.)

Fig. 194.

Head Passing through the Inlet in Flat Pelvis.

The anterior parietal bone, pressed against the anterior pubic wall, according to the description of Kleinwächter, becomes the fixed pivotal point around which a partial revolution of the posterior parietal occurs in the descent until the promontory is cleared. But in order that this descent can occur, the transverse diameter of the head must be lessened;

[1] Kleinwächter.

this lessening is in part accomplished by the lateral margin of the posterior parietal passing under the corresponding part of the anterior parietal. In some instances the revolution is reversed; that is, the posterior parietal is fixed at the promontory, while the anterior moves down; then the relations of the parietals are changed, in that the posterior overrides the anterior. Further diminution of the head transversely may be effected by indentation, deep depressions, or even fractures or fissures of the revolving parietal. After the head has passed the inlet the subsequent mechanism is the same as in normal labor, and often then the delivery is more rapid from the ampler space furnished by the cavity, and especially by the outlet in the pelvis flattened by rickets, as has been previously mentioned. Nevertheless, as stated by Litzmann, often the uterine contractions fail in force in consequence of exhaustion from the prolonged effort made in forcing the head through the inlet, so that the delivery must be completed by art.

In exceptional cases the sagittal suture is placed so near the pubic or the sacral wall of the inlet that what is termed a parietal presentation results; if this presentation is not rectified, delivery is impossible without craniotomy. Descent of the frontal bone first may occur in great narrowing; then the two halves of the bone play a corresponding part to that of the parietals in relation to the pubic and the sacral wall of the pelvis. Whether the parietals or the frontal halves pass the strait first, the posterior bone has a distinct pressure-mark from its being so strongly forced against the promontory.

In pelvic presentation one or both feet usually descend first; if the contraction is slight, the body passes through it without serious difficulty; then the head may pass also—of course, it must be in a transverse position for this passage—flexion being continued; the posterior parietal bone suffers from pressure in descending the promontory. In more decided narrowing departure of the chin from the chest is observed.

The mortality of mothers is more than 7 per cent., and of children 50 to 60 per cent. The prognosis is more favorable in the case of female than of male children, and it is also more favorable if the woman be a multipara than if a primipara, provided the head presents.

In the management of the labor care should be taken to keep the membranes unruptured until the os is dilated, and hasty intervention while the head is being moulded to pass through the narrowed inlet must be avoided. If nature is unable to effect the passage of the head through the inlet, resort to the forceps is not indicated, but podalic version. In regard to the former means, Zweifel observes that the application of the forceps to the movable head is not impossible, but to seize it firmly is purely accidental; an application of the blades over the parietal bones is absolutely impossible; and even if the head were thus grasped, it could not be drawn through the conjugate. Version comes only in those cases in which the forceps cannot be used; and even then the question, as Schröder has framed it, is, Shall we turn, or wait? "Whenever we perform version in contracted pelves we decide in favor of this operation without knowing, in case this is not done, how the head would enter the true pelvis and how it would pass through.

This renders the question as a practical one so difficult, and will probably thus keep it for a long time, probably forever."

The usual rule is to wait after rupture of the membranes and dilatation of the os, with the hope that the head may enter and pass the inlet; but if after a reasonable delay this does not occur, podalic version is to be employed.

Generally-contracted Flat Pelvis. In this variety there is a greater degree of descent of the sacral promontory than is found in the generally-contracted pelvis, and the deformity rarely occurs except as a consequence of rickets. Not only all the pelvic diameters are below the normal, but the true conjugate especially is shortened.

Litzmann states the mortality of mothers with this pelvic deformity is between 8 and 9 per cent., and of children delivered dead or dying, there are 66 per cent.

The Spondylolisthetic Pelvis (from σπόνδυλος, probably, more correctly, σφόνδυλος, vertebra; and ὀλίσθησις, a slipping or gliding). This deformity arises from a gliding or slipping forward of the last lumbar vertebra, so that it no longer rests upon the upper surface of the first sacral vertebra completely, but only partially; or even, in an excessive degree of spondylolisthesis, the posterior wall of the body of the former vertebra may be fixed to the anterior wall of the body of the latter, a synostosis occurring. Sometimes, indeed, the lumbar vertebral column glides down to the body of the second sacral vertebra. The lumbar vertebræ thus sinking, lordosis results, and the lower edge of the fourth lumber vertebra, or the union between the third and fourth, or even that between the second and third, is opposite the pubic joint.

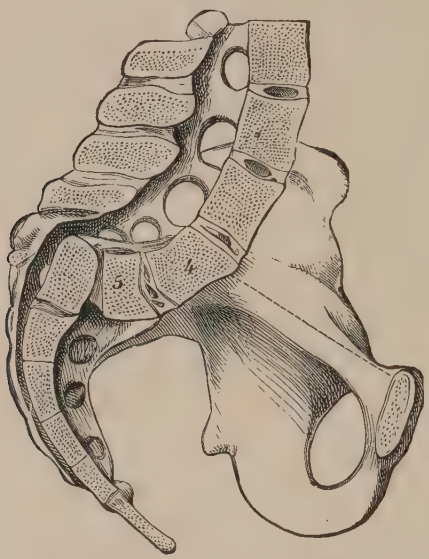
This pelvis was first described by Rokitansky. The question as to the cause of the deformity has been much discussed. From the firmness of the transverse processes of the normal vertebræ it would seem impossible for a dislocation of one of the bodies to occur; and the view generally held as to its origin in the majority of cases is that it results from a fracture of the vertebral arch anterior to the articulating processes—this fracture caused by a fall upon the sacrum—and hence dislocation becomes possible. "If a person should thus fall with the body bent forward, the sacrum being fixed at the moment of the accident, the force will mainly act upon the body and arch of the last lumbar vertebra, and a fracture of the acrh would very probably occur." Zweifel remarks that we cannot overlook the weak side of this, F. L. Neugebauer's theory, which is, that hitherto the traces of such a healed fracture have been found in only one case.[1] Nevertheless, he also states that a traumatic, and hence extra-uterine, origin of spondylolisthesis must be admitted for the majority of cases. There may also be congenital spondylolisthesis, the origin of the disease, from the failure of coalescence of ossification-centres in the vertebral arches, thus permitting dislocation of the vertebral body. This deformity is rare; Kleinwächter, writing in 1882, states that only fourteen cases have been observed.

The diagnosis is made by the increased distance between the posterior superior iliac spines; by the marked lordosis just above the sacrum; by the shortening of the abdomen, its contents sinking so much between the ilia; by the peculiar "rocking gait" of the pregnant woman, by the absence of any history or present manifestation of rhachitis or of osteomalacia; by an account of a fall such as would result in fracture of the

[1] Winckel mentions two cases under his observation, in which the probability was that the deformity had its origin as Neugebauer has stated.

arch of the fifth lumbar vertebra; but, above all, by internal examination, counting the bodies of the sacral vertebræ, and recognizing the projecting lumbar vertebra by finding the sacral vertebræ complete, and by the absence of the alæ in this, which belong to the first sacral. In Olshausen's case, the bifurcation of the aorta could be felt on the deeply-sunken lumbar vertebral column.

FIG. 195.



SPONDYLOLISTHETIC PELVIS, SHOWING DISLOCATION INTO THE PELVIC BRIM OF THE LUMBAR VERTEBRÆ (KILIAN). THE "PRAGUE PELVIS."

4. Fourth vertebra. 5. Fifth lumbar vertebra.

The Cæsarean operation is unavoidable in a severe spondylolistnesis. Slight degrees of the deformity are much more common than was at first supposed, and the prognosis is, according to Zweifel, no more unfavorable than it is in the flat rhachitic pelvis.

THE PELVIS FLATTENED FROM BILATERAL DISLOCATION OF THE FEMORAL BONES. Whether the double dislocation be congenital or occur early in childhood, the heads of the femurs pressing above and posteriorly to the acetabula, "great traction is exerted upon the round and upon the ilio-femoral ligaments; the muscles of rotation passing from the inner side of the pelvis to the femur, the obturators and gemelli are also made tense Hence traction in a transverse line at the pelvic outlet and its partial eversion. By the tension of the ilio-femoral ligaments passing from the capsule to the anterior inferior spinous process, and in consequence of the place of support of the trunk, the heads of the femurs, being placed further back, the centre of gravity is thrown anterior to the plane of support; continual care is necessary to prevent falling forward, and this is exerted by the dorsal muscles drawing the body backward, the consequence of which is, the inclination of the pelvis is lessened, and there is a lumbar lordosis. Tension upon the pelvic ring causes increase in the transverse diameter of the inlet and flattening of the pelvis, with necessary shortening of the conjugate; the latter diminution is also increased by sinking of the sacrum." Not only the conjugate is lessened, but usually the corresponding diameters of the cavity and of the outlet, though, according to Kleinwächter, this lessening becomes less at

the outlet in consequence of the recession of the lower part of the sacrum, while, on the other hand, it may be that resulting from tension upon the ligamentous connections between the ischial tuberosities and spines upon the lower portion of the sacrum, the latter is drawn forward, and then there necessarily follows lessening of the antero-posterior diameter of the outlet.

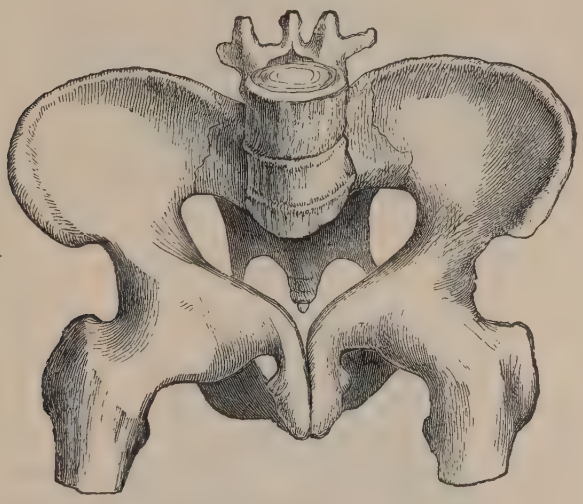
The true conjugate rarely falls below nine centimetres, but in some it has been reduced to seven. The characteristics of this pelvis are, in addition to the lessened conjugate, the increase of the transverse diameter, the fact of the double luxation, the greater breadth of the pubic arch, the lessened pelvic depth, and the flattening of the pelvic inlet. The diagnosis in the living subject is greatly facilitated by observing the duck-like gait. This pelvic anomaly, if we know the peculiar walk of those having such a basin, Zweifel states, can be diagnosed at a distance of two hundred steps.

This variety of pelvic deformity is quite rare; according to Kleinwächter, only nine of such pelves have hitherto been observed. The labor usually ends favorably both for mother and child; after the head once passes the inlet the progress is quite rapid.

The Second Class includes *Pelves chiefly Narrowed in the Transverse Diameter.*

a. The osteomalacic pelvis. Osteomalacia (from *ὀστέον,* bone, and *μαλάχὸς,* soft—mollities ossium, softening of the bone) is a disease of which the essential cause is a diminution of the earthy salts of the bones, this diminution being such that these salts are two, three, or even five times less than normal, and of which the most marked results are

FIG. 196.



OSTEOMALACIC PELVIS, SHOWING THE BEAK-LIKE SHAPE OF THE PUBES.

changes in the forms of the bones in consequence of their great flexibility. It is not a disease belonging exclusively to adult life, nor to the female, nor to childbearing. Nevertheless, the statistics of Collineau indicate very clearly the frequent origin of the disease in consequence of changes of the organism caused by pregnancy. He found only 14 of 43 women suffering with osteomalacia who had never been pregnant, and of the other 29, 14 who had had from four to ten preg-

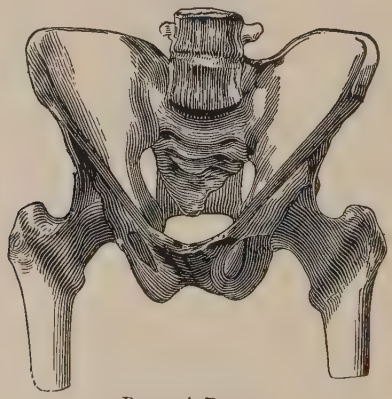
nancies, 6 one to three, and 4 who had been pregnant but once. Thus it is seen these statistics prove that the majority of cases of the disease are connected with pregnancy. It may appear during gestation or in the puerperium; once begun, the disease is aggravated by succeeding pregnancies, especially if the intervals are short.

It is impossible to explain satisfactorily the anomaly of nutrition which is essential to the disorder. "While true that the disease has never been observed in women comfortably situated in life, even the lack of good nourishment, miserable and damp dwellings, a diet exclusively of potatoes or of rice, cannot be regarded as the absolute cause of the disease, though the conditions just stated are undoubtedly predisposing causes. If deficient nourishment of the bones in the large majority is the sole cause, so that the bones, losing their earthy elements, are softened, then osteomalacia would be much more frequent. A fact that is inexplicable is, that the disease occurs usually only rarely and sporadically, but in some countries very frequently, so that it may be called endemic; thus it is found on the banks of the lower Rhine and in the adjacent valleys, in East Flanders, and on the plains of the Po." The fact of its frequently being seen in India has previously been stated.

The changes in the spinal column and in the pelvis result from softening of the bones affected by pressure and by traction. The spinal column, corresponding to its normal curvatures, is pressed by the weight of the body, and hence follow kyphoses, kypho-scolioses, and lordoses. "The weight of the body causes by its pressure upon the sacrum pushing of the promontory downward and forward, and the sacrum draws anteriorly the posterior halves of the ilia, so that they are bent. The sacrum is narrowed, especially from lessened expansion of the alæ, and it is also bent forward. The pressure from the femurs forces the acetabula and adjacent parts inward and upward, so that the pubic joint and horizontal rami are pressed forward, the rami becoming parallel and proximate, so that the ilio-pectineal eminences are adjacent." The illustration given shows the beak-like projection of the pubic joint—pelvis rostrata. The pubic arch almost entirely disappears, and while the antero-posterior diameter of the inlet may be increased, the available space is seriously lessened. The pressure upon the acetabula always makes the outlet less than the inlet.

In making the diagnosis of deformity of the pelvis from osteomalacia, the history is of great importance; for example, the period when the

FIG. 197.



ROBERT'S PELVIS.

disease was first manifested—just following pregnancy; the severe pains felt—tearing and drawing, mistaken in some cases for violent

rheumatism. The patient's walk is characteristic, for in consequence of the approximation of the acetabula the femurs are brought near, and she is compelled at each step to turn on one foot, while the other is thrown around and in front of it. Those affected with the disease are small, and as it progresses they grow smaller.

The bistrochanteric diameter is lessened; the external conjugate is not lessened in all cases, but the promontory is always accessible, the narrowed pubic arch and the approximated horizontal pubic rami giving a beaked form to the anterior portion of the pelvis; and, finally, the diminished outlet will be more or less readily recognized.

A general rule in regard to the conduct of labor in a case of osteomalacic pelvis is not to interfere too early, for the bones may prove so yielding under uterine contractions that the passage for the fœtus is opened, and thus Cæsarean section or embryotomy be averted. Because of the yielding of the pelvic bones to the pressure of labor, the pelvis has sometimes been called the India-rubber pelvis.

FIG. 198.

LUMBO-SACRAL KYPHOSIS (Mütter Museum, College of Physicians, Philadelphia).

b. The ankylotic transversely-contracted pelvis. The first pelvis of this kind was described by Robert in 1842. Its origin seems to be in an arrested or imperfect development of the sacrum, followed by ankylosis of the sacro-iliac joints. The alæ of the sacrum are absent or only imperfectly developed; the sacrum is narrow, and has descended deeply between the ilia; the ischial tuberosities and spines approach. The antero-posterior diameters of the pelvis are normal or increased, while the transverse are much lessened; especially is the transverse of the outlet reduced. Kleinwächter states that in the cases hitherto observed the transverse of the inlet varied from 7 to 10 centimetres (2.7

to 3.9 inches), and that of the outlet from 2.25 to 6 centimetres (0.8 to 2.7 inches).

The diagnosis is made by the narrowed pubic arch, the parallelism of the horizontal pubic rami without any abrupt bending of these bones which is observed in the osteomalacic pelvis, and chiefly by the great narrowing of the sacrum. This is a very rare anomaly, only nine cases having been observed. In six of the nine the Cæsarean operation was done. In two cases in which the transverse diameter of the inlet was 8 centimetres (3.1 inches), and that of the outlet 5.25 centimetres (2 inches), delivery was effected by cephalotripsy, and this is, therefore, regarded as the limit of its applicability.

c. *The kyphotic transversely-contracted pelvis.* Kyphosis (κύφωσις, applied by Hippocrates to a bowing or curving of the spine, so that one was humpbacked) means an abnormal convex curvature of the spine.

The origin of the kyphotic pelvis is found in an abnormal posterior spinal curvature, for a compensating curvature lower down results from the former; and in order that the pelvis may be affected by the spinal anomaly, the latter must be situated in the lumbar vertebræ, or in these the sacral vertebræ must be affected, the one known as lumbo-dorsal, the other is lumbo-sacral, kyphosis. Further, the sacrum is pushed downward and backward: just as in a pelvic deformity previously considered this bone is pressed downward and forward, lessening the conjugate, a rotation of the bone upon its transverse axis forward, so that the sacral promontory is brought nearer the pubic joint, so now a corresponding rotation backward is claimed to occur.

Barbour gives the following summary of the peculiarities of the kyphotic pelvis based upon his examination: "The iliac crests are drawn out from before backward; the arching of the crests is diminished and their sigmoid curve lessened. The anterior superior spines are thrown apart. The pelvis is funnel-shaped. The conjugate diameter is greatly increased, while the transverse is relatively, and sometimes absolutely, lessened. The linea terminalis is less arched at the sides. In the cavity the conjugate is increased, but to a less extent than at the brim. Sacrum narrowed transversely and elongated vertically; its vertical curvature is diminished throughout, its transverse in the upper portion of the bone. At the outlet the conjugate is not usually altered. The transverse may be contracted, and that to an extreme degree. The pubic arch is narrowed."

The most characteristic anatomical peculiarity of the kyphotic pelvis is an increase in the antero-posterior diameter of the brim. The contraction in the transverse diameter of the outlet, which is the feature of obstetric importance, is not so constant.

Further, Barbour, in opposition to the teaching of Breisky, states as the result of the study of the preparations he has had that there is not, as a rule, a rotation of the sacrum upon a transverse axis, and that the contraction at the outlet is not related to the elongation at the brim. He further maintains that the contraction at the outlet implies a rotation of the innominate bones; and this is shown by the fact that the approximation of the tuberosities is related to separation of the crests.

The most characteristic indication of the kyphotic pelvis is found in the presence of a lumbar kyphosis, and next in the peculiar walk of the subject, the movement being as if carrying some heavy load before her and a constant effort to avoid falling. By pelvimetry we find the true conjugate increased; the transverse measurements of the false pelvis are normal, but that between the posterior iliac spine is lessened.

The distinction just given is the direct opposite of the conditions observed in the osteomalacic pelvis, with which this may be confounded, for in that the anterior transverse diameters of the false pelvis are lessened, while the distance between the posterior iliac spine is increased. The pubic arch is narrowed in the rhachitic and also in the osteomalacic pelvis, while no narrowing is present

in this. Besides, the first two occur in persons whose history points to one or the other disease. In such a pelvis, too, the promontory is quite accessible.

Of course, the prognosis rests chiefly upon the degree of contraction. It is of especial importance in this connection to know the transverse diameter of the outlet. Further, it is important to know if "the ischial tuberosities move upon being pressed apart. Korsch has demonstrated that even in the normal pelvis the transverse of the outlet can be thus slightly increased, this movement being accompanied by a diminution in the conjugate."[1] But before this observation both Mattei and Laborie had asserted that an increase in the transverse diameter of the outlet resulted from the wedge-like pressure of the fœtal head.

In consequence of the lessened abdominal capacity arising from a lumbar kyphosis, the uterus may be strongly anteverted, and, hence, difficulty in the head entering the inlet. But the most frequent fact as to the position of the child in the abdomen that has been observed is that the fœtal back is posterior—that is, toward the mother's spine—"probably in consequence of the pendulous abdomen generally present, the limitation of abdominal space, and the compensating lordosis of the upper portion of the spinal column, through which the anterior plane of the fœtus can be better adjusted to the anterior abdominal wall." This explains the frequency of occipito-posterior positions. According to Barbour, the shape of the pelvis favors posterior rotation of the occiput.

He gives a table of 32 cases of kyphosis and 52 labors; there were 33 recoveries from these 52 labors, but of the 32 mothers, 19 ultimately died after labor. He thus finds in his collection of cases that there was a fœtal mortality of 52 per cent. and a maternal mortality of 36.5 per cent., according to the number of confinements, or 59.4 per cent., according to the number of cases of kyphosis.

The extreme limit admitted by Barbour for the application of forceps is 3.25 inches, and if this diameter is less he advises craniotomy. There were 7 cases of Cæsarean section, 6 mothers dying; 9 cases ended spontaneously, and 7 mothers recovered. Zweifel regards the prognosis as more favorable in this than in other pelvic contractions, because the narrowing is at the outlet. But he adds that Cæsarean section has been necessary, and as spontaneous rupture of the uterus has occurred, and even after the use of the forceps death rapidly followed, it is advisable in a given case to keep this possibility in mind.

Rhachitic Kyphosis.[2] While the changes in the pelvis caused by rickets are in the main directly opposed to those caused by kyphosis, on the other hand, should kyphosis result from rickets, the pelvis may present a similar form to that observed if the kyphosis has a different etiology. The kyphosis, in order to change the form of the pelvis, must, as in the account of the kyphotic pelvis just given, concern the lumbar vertebræ. The diameters of the outlet are lessened, and the diminution is greatest in the antero-posterior.

The Third Class includes *Pelves chiefly Contracted in the Oblique Diameter.*

a. The ankylotic obliquely-contracted pelvis. Dionis was credited by

[1] Barbour, op. cit.

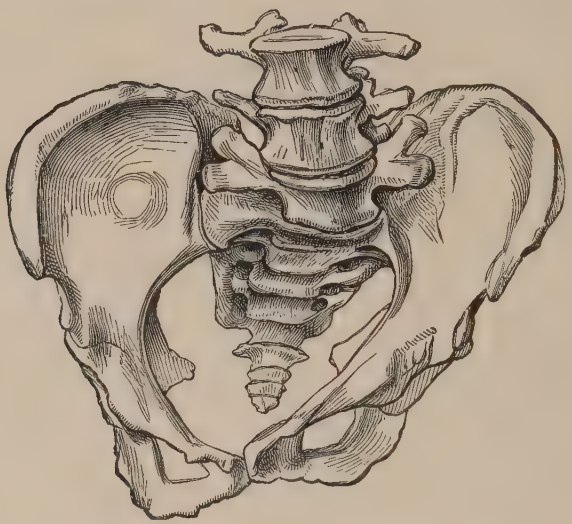
[2] Zweifel.

Naegele with having first alluded to the pelvis contracted in an oblique diameter. Certainly, this distinguished French accoucheur does refer to difficult labor caused by spinal deformities, and also to changes in the pelvis caused by rhachitis, but his reference to the pelvis now to be considered is by no means clear.

The oblique-oval, or Naegele's basin, was first described by Naegele in 1839. It is distinguished by the fact that one sacro-iliac synchondrosis has been ossified, and, as a consequence, one-half of the basin becomes narrower.

The part of the sacrum belonging to the ankylosed side is imperfectly developed, and its union with the innominate bone is made by a

FIG. 199.



OBLIQUELY-DISTORTED PELVIS, OR NAEGELE'S PELVIS.

narrow ledge of greatly condensed osseous tissue instead of by a broad articulating surface. There is slight scoliosis involving the lumbar vertebræ. In Kleinwächter's case there was also rhachitis. The iliac bone of the affected side is raised and projects further back than its fellow. The sciatic notch is lessened in consequence of the ischium being pressed upward and inward, and the ischial tuberosity and spine approach the sacrum.

The absence or rudimentary condition of the sacral wing upon the affected side finds its most rational explanation in the absence of ossification nuclei, and, therefore, the deformity may have an intra-uterine origin; this was the view favored, though not exclusively, by Naegele. But it is also held that the deformity may result from pathological conditions of the joint in infancy or childhood; in other words, inflammation lies at the beginning of the change. The theory of an inflammatory origin in some cases after birth does not exclude that possibly this inflammation may begin in intra-uterine life; if the inflammation occurs after birth, its cause may be simply pressure of the trunk, which will

be greater upon that side corresponding with an imperfectly developed sacrum. It is impossible for disease of one of the sacral joints in adult life to cause the deformity.

Thomas,[1] in 1861, from a study of the 50 cases of oblique oval basin up to that time described, classified them as to their etiology as follows:

a. Oblique pelves found in women who during their infancy, or in all cases before the ankylosis was recognized, had suffered from disease of the pelvic bones, 9 cases.

b. Oblique basins with fracture of the pubis on the same side as the ankylosis, 2 cases.

c. Oblique basins with traces of periostitis or exostosis of the hip-bones, 3 cases.

d. Oblique basins in which there was found, beside the ankylosis, a coxal arthritis of the same side or of the opposite side, 5 cases.

e. Oblique basins without any other trace of disease, of which, nevertheless, the history was too imperfectly known to permit the absolute statement that in the women to whom these pelves belonged there was nothing observed, especially in youth, indicating a morbid state of the pelvic bones, 27 cases.

f. Oblique basins without visible traces of disease of the pelvic bones in women whose history was sufficiently well known, so that it could be affirmed they had never suffered from any affection of the bones.

Whatever or whenever the origin of the deformity, the latter presents a most characteristic form which is well shown in the illustration that has been given. The pelvic inlet is asymmetrical, and presents the form of an obliquely placed oval with a point projecting to the ankylosed side. The antero-posterior diameter is increased, but the transverse is lessened, and there is a continued lessening of this diameter through the cavity and to the outlet.

Most of the cases of obliquely-contracted pelvis have been diagnosed after death; the entire number of cases observed is given as about fifty, but probably this is too small. Zweifel states that with a great difference between the two sides of the pelvis the diagnosis during life cannot be difficult. Should there be delay during labor in the entrance of the head into the pelvis, the possibility of this deformity will be suggested if we find it impossible to reach the sacral promontory. The limping gait of the subject may not be observed, but it is important to learn whether there is any history of inflammation of the joint in infancy or childhood, and whether any evidences of suppuration following such inflammation can be found in healed sinuses. Freund claimed that, an examination being made *per rectum*, the woman standing alternately on one and then on the other foot, some movement would be detected in an unaffected joint, while the ankylosed one would be immobile.

Internal examination should be made with the half or with the whole hand, and thus the want of correspondence in the position of the ischial spines, the distortion of the promontory, and the displacement of the pubic joint will be learned. The most important external measurement in order to prove that the basin is asymmetrical is the distance between the trochanter major of one side to the iliac crest of the other, and *vice versa*.

Naegele directed the following measurements to be made:

1. From the posterior superior spine of one side to the anterior superior spine

[1] Das Schrägverengte Becken, quoted by Naegele and Grenser.

of the other side—from the right side behind to the left side in front—normally 21.22 centimetres.

2. From the trochanter major of one side to the posterior superior spine of the other—22.25 centimetres.

3. From the middle of the inferior margin of the pubic joint to the posterior superior spine of each side—17.25 centimetres.

4. From the ischial tuberosity of one side to the posterior superior spine of the other—17.5 centimetres.

5. From the spinous process of the last lumbar vertebræ to the anterior superior spine of each side—18 centimetres.

These oblique diameters, as Naegele termed them, must show a difference between each two corresponding ones of more than one centimetre in order to make the diagnosis of obliquely-contracted pelvis.

In this pelvis, if the ankylotic contraction be great, the passage of the child is necessarily made through that portion of pelvic space corresponding to the healthy side, for that which belongs to the ankylotic side is so contracted that no part of the fœtus can be admitted. The space, then, that is available is quite similar in form to that given by the justo-minor pelvis; and if labor be possible the mechanism is the same, the occiput descending first, as has been described in the course of labor occurring in that pelvis. Presentation of the breech is very unfavorable, because of the great difficulty in, or impossibility of, the passage of the head.

The prognosis as to the mother of course depends upon the degree of the deformity, the vigor of labor-forces, the size and degree of resistance to moulding of the fœtal head, and the size of the child; the maternal mortality given by Litzmann and Thomas is 80 per cent. But this high percentage is to be attributed to the fact that in most of the cases the deformity was not recognized soon enough for the use of appropriate therapeutic means, and in some instances, according to Kleinwächter, the means employed directly caused the death of the mother. Zweifel, too, regards Litzmann's statistics as being too unfavorable. He advises the forceps if the head enters the pelvis, but if this entrance be impossible the Cæsarean operation, especially as in cases of such difficulty uterine rupture is liable to occur.

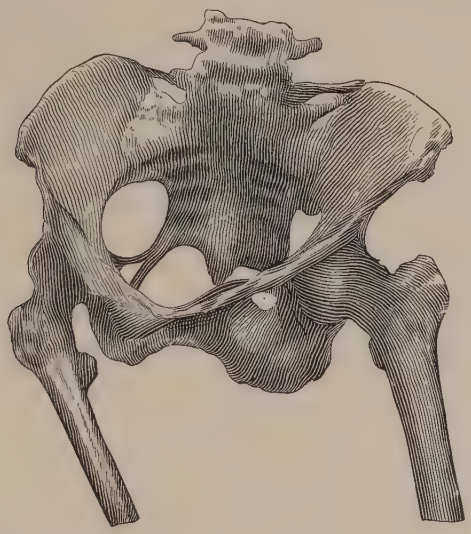
b. The coxalgic obliquely-contracted pelvis. This pelvis is similar to that just described, but there is this remarkable difference in manifestation: While in the Naegele pelvis the arrest of development or the inflammation of the sacro-iliac joint affects the side of the basin in which it occurs, in this deformity the coxitis and subsequent ankylosis are upon the side of the pelvis which remains comparatively normal, and the healthy side becomes misshapen.

The pelvis, represented in Fig. 200, was taken from a negress upon whom Dr. R. G. Curtin performed Cæsarean section, and it exhibits very clearly the fact of the pelvic deformity being manifest upon the healthy side, while that upon which the coxitis occurred is normal. The history of the usual development of this pelvis is that a child suffers from coxitis so severely that the corresponding lower limb—for example, let the affection be upon the right side—becomes useless, and the weight of the body rests upon the left femur. This pressure causes similar changes in form in the basin to those observed in the Naegele. The left acetabulum is pressed upward, and it comes more in front; the innominate line is bent in front at an acute angle, and the left ilium is higher and less inclined; the left half of the sacrum is narrowed, so that the entire bone loses its symmet-

rical form; the left ischial tuberosity and spine move backward and outward, and the pubic joint is placed opposite the right side.

There are several modifications of the coxalgic oblique basin according to the period in adolescence when the disease of the joint began and as to the degree of use permitted by the diseased limb. Thus, the earlier in childhood the disease occurs and the more the limb is used, the greater the deformity. On the other hand, if the coxitis is first manifested after complete development of the basin, the obliquity may be completely absent.

FIG. 200.



A COXALGIC OBLIQUELY-CONTRACTED PELVIS (Mütter Museum, College of Physicians, Philadelphia).

So, too, the obliquity may involve first one side, and then it may change to the other. Zweifel gives the following illustration: A child has coxitis of the right side, ending in firm ankylosis, the right lower limb being shortened. It necessarily limps, and the concussion in walking will be greater than on the left side, this jar being felt not only at the hip-joint, but also in the corresponding sacro-iliac synchondrosis; hence, ascension of the iliac bone. If now a chronic inflammation in the sacro-iliac joint is superadded, the corresponding sacral wing will be retarded in its growth; hence the right half of the pelvis becomes smaller than the left half, the pubic symphysis is pushed to the left, and the oblique diameter of the pelvis from the left anteriorly to the right is shortened. Suddenly, however, all this may be changed, so that by muscular traction a pelvis presenting an opposite contraction may be developed. For if the child ceases to use the right lower limb, the plane of support is exclusively given by the left femur. But it is not necessary to follow the changes that then result in the form of the pelvis, the diseased side furnishing comparatively a normal condition of the corresponding side of the pelvis, and the healthy side becomes in this regard abnormal.

Paralysis of a lower limb or amputation of a leg is rarely followed by any great change in the form of the basin, because in the great majority of cases this has attained complete development before either occurs.

The coxalgic pelvis so gravely deformed as seriously to interfere with labor is rarely seen. The recognition of the deformity will be made,

first, by having a history of coxitis in early life, and finding its effect in a useless abdominal member, and then by a direct examination of the pelvis. In slight cases of the deformity labor needs no assistance, while in the gave ones labor and its treatment are the same as advised in similar circumstances in the Naegele pelvis.

c. The scoliotic obliquely-contracted pelvis. This deformity arises from a scoliosis involving the lumbar vertebræ, there being thus caused a greater pressure upon that half of the upper articulating surface of the sacrum corresponding with the side toward which the spinal curvature occurs. By the connection of the sacrum with the innominate bone this increased pressure is transmitted to the femur of that side. But the resistance of the latter causes leaning inward of the parts adjacent to the acetabulum, and hence that side of the pelvis becomes greatly lessened. A scoliosis of the vertebræ toward the right diminishes and deforms the right half of the pelvis, while the left is similarly affected by a scoliosis with its curve directed to the left.

Should the scoliosis be limited to the dorsal vertebræ, a compensating curve of the lumbar vertebræ may prevent any influence upon the pelvic form.

This deformity renders one side of the pelvic canal useless, so far as furnishing space for the transmission of the child. The mechanism of labor is that described as occurring in the justo-minor pelvis, and the assistance to be given by the obstetrician, provided the contraction be not so great as to forbid the passage of a living child, is by forceps, remembering, however, that this instrument is not to be used until the head has been sufficiently moulded.

Deformities of the Pelvis caused by Fractures or by Neoplasms of the Pelvic Bones. Fracture of the horizontal ramus of one of the pubic bones may result in serious deformity of the pelvis, because of the impossibility of keeping the broken ends of the bone in apposition during healing. Eugene de Saint-Moulin[1] narrates the case of a girl sixteen years of age who, while working in a coal-mine, was injured by the falling of a large mass of coal upon the lower portion of her back; after several months she recovered so that she could walk, though with some difficulty, and there was slight spinal deformity. Five years afterward she became pregnant, and the diameter of the superior strait being only three centimetres six millimetres, the Cæsarean operation was successfully done at the end of the pregnancy. Seven years after she was again pregnant, and at seven months rupture of the uterus occurred, the tear being in part of the uterine incision made in the previous operation, and the rupture ended fatally. The autopsy showed that, in addition to marked lumbar lordosis, the second sacral vertebra was crushed, so that the first was directly buried in the pelvic cavity, and there was a synostosis between its inferior border and the superior border of the third sacral vertebra. The spondylolisthesis had thus a very rare origin in this case.

Various neoplasms—enchondroma, sarcoma, carcinoma, exostosis, fibroma—may, originating from any part of the internal surface of the

[1] Journal d'Accouchements, 1885.

pelvic bones, encroach so greatly upon the bony birth-canal that the Cæsarean section is necessary.

Deventer, who was the first obstetrician to give any clear exposition of pelvic deformities, regarding the position of the coccyx as sometimes causing a serious obstacle to labor, occupied several pages of his well-known work with the subject, and gave directions as to pushing the head back and thus enlarging the pelvic outlet. Since then other obstetricians have urged the hindrance in labor from sacro-coccygeal ankylosis. The pressure of the child's head in labor is sufficient to overcome the resistance.

Effect of Increased and of Lessened Pelvic Obliquity in Pregnancy, and in Labor. If the inclination of the pelvis be notably increased, a pregnant woman will especially suffer from pendulous abdomen, and in labor delivery may be impossible when she is lying upon her back, and therefore it will be necessary for her to be upon her side.

If the inclination of the pelvis be much lessened, and labor rapid, rupture of the perineum is almost inevitable. According to Ahlfeld, if with lessened pelvic inclination there are associated narrow vagina and a broad perineum, this rupture may be central, the child delivered through the rent, while the anal and the vulval openings remain intact.

CHAPTER VIII.

ANOMALIES OF THE FŒTUS AND OF THE FŒTAL APPENDAGES.

ANOMALIES of the fœtus include those of size, form, and presentation —the last may be complex instead of simple, or may be abnormal in other respects—other fœtal anomalies may be malformations and monstrosities, single or double. The cord may be relatively or absolutely shortened, or it may prolapse, and the membranes may be unusually resistant.

ANOMALIES OF THE SIZE OF THE FŒTUS. These may be general or partial, physiological or pathological.

Great Size of the Fœtus. This may relate to the head only, or the body also. The diagnosis of great size of the fœtal head prior to birth is uncertain; abdominal palpation previous to, or during labor, and by touch finding the distance between the anterior and the posterior fontanelle to be greater than usual, are thought by some to furnish useful information. Could we know the sex of the child we might be assisted in the diagnosis of the size of the head. In multiparæ advanced in age it is usual to find that the child if male has a very large head. In primiparæ more than thirty years of age the children are larger than in young primiparæ. Possibly the patient's previous labors have been protracted in consequence of the great cranial development with premature ossification of the bones of the head, and they all may have ended in the birth of dead children. In case of prolonged pregnancy, as a rule, the development of the fœtus, especially of the head, is greater than if the labor occur at the normal time.

Blake takes the ground that it would be a very judicious rule of practice in any dystocia caused by a large and prematurely ossified fœtal cranium not to consider the question of forceps delivery. "We may resort to the perforator with less than our usual repugnance to its use if we bear in mind the fact that quite a proportion of children born with closed or partially closed fontanelles and ossified sutures will, if not early cut off with symptoms of brain irritation and pressure, be epileptic and idiotic."[1]

Jacobi states that premature ossification of the sutures and fontanelles occurs particularly with the first child, and in the milk of young mothers the phosphates are predominant as compared with the milk of mothers later in life.[2]

The induction of premature labor is clearly indicated in the case of a pregnant woman whose previous pregnancies have ended in stillbirths from the great cranial development of the children. One of the most frequent causes for the application of the forceps is the necessary disproportion which exists between the head and the normal pelvis; if the former be unusually large, turning is not advisable, but in some instances craniotomy may be necessary.

[1] American Journal of Obstetrics, vol. xii.

[2] Ibid., p. 358.

Jacquemier has said that after spontaneous or artificial delivery of the head it was thought by some that the shoulders became too large by development of the chest, and presented an obstacle to the escape of the fœtus so that it was impossible for the uterus alone or assisted by the usual artificial means to expel it, at least as promptly as required by its precarious situation thus suspended between intra- and extra-uterine life. It is not, however, the great volume of the shoulders so much as that of the chest which causes the delay, conjoined with some degree of uterine inertia. When this difficulty is anticipated the practitioner must beware of deep anæsthesia, provided an anæsthetic be administered, during the delivery of the head, lest, even if uterine inertia be not thereby invited, the voluntary expulsive efforts of the patient may fail when they are most needed.

Difficult delivery of the shoulder is considered on pages 306 and 307. Fracture of the clavicle has occurred in some cases from direct pressure of the obstetrician's fingers in endeavoring to extract the inferior shoulder.

Partial Increase in the Size of the Fœtus. 1. *Hydrocephalus.* By this is meant abnormal accumulation of serous liquid in the cranial cavity. It is met with once in 3000 births. It has been attributed to syphilis, alcoholism, cretinism, and to marriages of consanguinity. The mothers were, in many instances, past forty years of age, and lived in bad hygienic conditions. Poullet[1] states there are cases in which women have a predisposition of unknown nature to produce hydrocephalic offspring, and cites an illustration from Franck of one who had in successive pregnancies seven children with hydrocephalus, and another from Goelis of one who had six. He also directs attention to the investigations of Dareste, who, in the artificial production of monstrosities, has caused dropsy of the nervous centres in experiments upon the embryo of the hen.

In hydrocephalus the cranial bones are usually much thinner than normal, and more flexible; they are flattened, are much more widely separated, and the fontanelles larger, and in some cases the latter occupy a greater extent than the ossified parts. In many cases of hydrocephalic heads there is a supplementary fontanelle, known as the fontanelle of Gerdy, situated between the anterior and the posterior fontanelles.

One of the characteristics of the hydrocephalic head is the marked triangular form of the face, the base of the triangle being at the forehead, which is broad and prominent, and presents a distinct suture, and the sides of the triangle rapidly approach, meeting at the chin.

The great development of the head interferes with the normal accommodation of the fœtus, and hence there is a much larger proportion of presentations of the pelvis.[2] Poullet found in 106 cases 30 in which the pelvis and 8 in which the shoulder presented. So far there has been no example of face presentation in hydrocephalus.

If the enlargement be not very great, spontaneous delivery occurs

[1] De l' Hydrocéphale Fœtale dans ses Rapports avec la Grossesse et l'Accouchement. Paris, 1880.

[2] Griffith suggests that the hydrocephalic head is more frequently in the upper part of the uterus, because the fluid it contains has a less specific gravity than that of the amnial liquor. London Obstetrical Society's Transactions, vol. xxix.

after a more or less difficult and tedious labor: "But in the largest number of published observations the efforts of nature were entirely powerless to effect the expulsion of the hydropic head, and after alternatives of contractions and inertia from exhaustion of the uterus, final inertia supervened, or uterine rupture occurred, the woman dying undelivered; this, at least, is the course of spontaneous labor without more or less able intervention, when the head was large."[1] In some instances, however, delivery may occur by the fluid passing from the interior to the exterior of the cranium, or it may become infiltrated in the connective tissue of the neck, of the chest, and of the abdomen, thus producing a general œdema. A still more singular lessening of the size of the hydrocephalic head may result from the fluid passing into the pleural or into the peritoneal cavity, and then the labor spontaneously ends. In some instances rupture of the head occurs, more frequently in presentation of the pelvis than of the head, and with the free evacuation of the fluid the obstruction to labor ends. If the slow labor demands the application of the forceps, the introduction of the blades and the locking are difficult, the handles are wide apart, and efforts at traction usually end in the blades slipping. It should be added, however, that if Tarnier's forceps is used, this accident is much less likely to occur. I have with it delivered a hydrocephalic head when a Hodge's instrument had been unsuccessfully tried.

Prognosis. This is most unfavorable for the child. The statistics of Chassainat[2] show that in 60 cases of fœtal hydrocephalus 41 died before or during labor, and only 19 were born alive; only 4 of the 19 lived for several years. Poullet regards this result as too favorable, stating that he has been unable after diligent search to find a case in which hydrocephalus caused dystocia and the child lived.

Diagnosis. If there is not an excess of liquor amnii, it may be possible to recognize the great disproportion between "the round and voluminous tumor made by the head, and the other tumor at the opposite extremity of the fœtal ovoid, and which may be distinguished as the pelvis." Upon auscultation when the head is below, contrary to that which is usual in head-first labor, the sounds of the fœtal heart are heard most distinctly higher than the umbilicus. Combining digital examination, after labor has begun and the membranes have ruptured, with abdominal palpation, it has sometimes been possible to perceive distinct fluctuation between the touching finger and the palpating hand. By vaginal touch alone a large surface, less rounded than the normal fœtal head, is felt; it seems like the bag of waters at first, but a more careful examination proves that its walls are thicker and more resisting than those of the fœtal sac, and possibly the hair may be felt; during a uterine contraction instead of the scalp being wrinkled it remains smooth and tense; it may be difficult to recognize the fontanelles or sutures, for the membranous spaces intervening between the bones are wide, but it will be possible to touch one of the cranial bones which will usually be found thin and quite yielding, and it is more flat and has a greater mobility. A macerated head, when the death of the fœtus has

[1] Poullet, op. cit.

[2] Quoted by Poullet.

occurred some time before, may give similar increase of mobility, but there is no increase in the size of the head; the bones override during a uterine contraction, the sounds of the fœtal heart cannot be heard, and the mother has not recognized fœtal movements for some days.

If the diagnosis is not clear using one or more fingers in the vaginal examination, the entire hand is to be employed.

The diagnosis of hydrocephalus in head presentation is sometimes difficult, but the difficulty is still greater in presentation of the pelvis; in most cases of the latter it is not made until after the body is delivered, and then a delay arises from the difficulty or impossibility of the head entering the inlet. During this unexpected delay it is not unusual for the child to die. Possibly if a finger be now introduced so as to feel the occipital bone it will be found thinner and less resisting than normal; by abdominal palpation it will be ascertained that the uterus is much larger than it should be after the delivery of the body of the fœtus; if there be difficulty in disengaging the arms, the great distance to which the finger must be carried to effect this disengagement is a probable indication of a hydropic head.

Treatment. There is but one thing essential, and that is, lessen the size of the head. Schröder and some others have advised puncture by a fine trocar with the forlorn hope that the child may survive, although he stated in 1880 that he knew no instance in which such survival occurred. The advantage of perforation is that the finger can be introduced into the opening, then curved so as to exert slight traction, thus, in some cases, speedily effecting delivery. Some obstetricians have recommended delivery by podalic version immediately after the evacuation of the fluid, but if the uterus be retracted it may be ruptured during the operation, and most obstetricians prefer delivery by the head; the extraction may be made with the forceps, if the instrument does not slip, or if it does, with the cephalotribe; Pajot[1] suggests extraction by taking a rod of wood two inches and a half long, to the middle of which a cord is attached, it is passed into the cranial perforation, which should be made through a bone and not in one of the sutures or fontanelles, given a transverse direction, and then pulling on the cord.

Perforation is advisable, too, in most cases if the pelvis presents, though in some the delivery may be effected by traction upon the lower limbs conjoined with supra-pubic pressure; this traction, however, has, in a few cases, torn the body away from the head, leaving the latter in the uterus, and therefore the force thus exerted should never be so great as to run this risk. Perforation has been made through the palatine vault, at the occipital bone, behind the ear, or through a lateral fontanelle.

The almost insuperable difficulty in reaching the head with an instrument led Van Huevel to suggest an easier method of evacuating the dropsical fluid, and it has in some cases been successfully employed. The spinal canal is opened as near the body of the mother as possible by a transverse incision two inches long; then a rubber sound with a firm mandarin is easily made to pass through the opening and up to the cranium; upon the withdrawal of the mandarin the fluid

[1] According to Poullet, this method was first suggested by Augier about the middle of the last century.

readily escapes through the catheter, and the head lessened in size may be readily withdrawn by traction on the body or lower limbs. (Fig. 201.)

Fig. 201.

Evacuating Fluid in Hydrocephalus by Opening Spinal Canal.

Fig. 202.

Meningocele.

Fig. 203.

Large Spina Bifida.

Sir James Simpson, in the case of a woman who had in her two pregnancies hydrocephalic children, the delivery of each being possible only by cranial perforation, in her third pregnancy induced premature labor, and she gave birth to a living child.

Encephalocele and Hydromeningocele. The tumor formed by an encephalocele may be hydropic, though it is not often that the enlargement from this cause is so great as to furnish an impediment to birth, but if it should the treatment is puncture, but some treatment of hydromeningocele may be necessary.

Increase in the Size of the Body of the Fœtus. The body of the fœtus may be greatly increased in size by hydrothorax, ascites, accumulation of urine in the bladder from closure of the uretha, cystic degeneration of the kidneys, tumors of the liver and of the spleen, fœtal inclusion, aortic aneurism, and spina bifida.

The fœtus dying and air having ready access, and expulsion being delayed, emphysema may result from decomposition, and the fœtus be greatly swelled.

Tumors appearing more frequently at the sacrum and coccyx than at the upper part of the trunk may interfere with labor.

It may be stated in general that when fluid collections, either in cysts or in normal cavities, cause dystocia, evacuation by puncture is indicated; solid tumors producing the same result may be lessened by knife or scissors.

Fig. 204.

Congenital Coccygeal Tumor.

Single Monsters. *Acardia, Acephalia, Anencephalia, Hemicephalia.* An acardiac monster is described by Schröder as originating from anastomosis of the vascular systems of twins contained in the same chorion, consequently of the same sex, the blood-pressure being greater in one than in the other; in the latter the circulation becomes too feeble, as a consequence the heart, the lungs, and a greater or less part of the trunk atrophy, and the monstrous fœtus is nourished at the expense of the one which is normally developed. The stasis thus produced in the umbilical vein which leaves it, may have as its consequence considerable hypertrophy and an œdematous tumefaction of the subcutaneous connective tissue. He adds that the acephalous monster is born frequently by the feet half an hour or three to twelve hours after the well-developed child. The hypertrophy of the trunk may render extraction necessary, and if this hypertrophy is very great make it exceedingly difficult; Mayer in such a case had to lessen the size of the trunk by the perforator. In hemicephalia or anencephalia there may be a large collection of serum in the ventricles, so that there is hydrocephalus. Difficulty in labor may come from the great development of the shoulders, especially if the head presents, for this is so small, unless enlarged as just mentioned, the way is not opened for the descent of the trunk. Delivery by podalic version is indicated; if version cannot be done, the hand may be applied to the head, or the finger introduced into the mouth, or the blunt hook used to make traction; if these means fail, the arms should be brought down.

Double Monstrosities. Such monstrosities are found four times oftener in multiparæ than in primiparæ, thus corresponding with the relative frequency of labors in these two classes. In a decided majority of cases the labor ends spontaneously, partly from the fact that frequently it is

premature, and partly because the mother in most instances has previously given birth to one or more children.

C. Veit[1] divides in three classes double monsters with reference to their obstetric relations.

I. Incomplete double formation. The union of the two is very intimate:

Diprosopus, two faces (*πρόσωπον*, the face); dipygus, two pelvic ends (*πυγή*, rump).

Kephalothoracopagus, double face, double rump (pagus, from *πήγνυμι*, to unite).

The mechanical difficulty depends upon the circumference of the double-formed parts. Frequently the forceps, or perforation, will be necessary in diprosopus.

II. Two developed fœtuses are united to a great or less extent at the upper or at the pelvic part:

Craniopagus.
Ischiopagus.
Pygopagus.

These double formations lie in a continuous line or can be so placed. The fœtuses pass through the pelvis without great difficulty.

III. Both fœtuses are united together by their bodies:

Thoracopagus, dicephalus.

In these there must be more or less great mobility of each body, or of the parts upon each other, in order that delivery can be effected.

The diagnosis of a double monstrosity will not be made until the labor becomes protracted, and the obstetrician, finding neither a narrow pelvis nor hydrocephalus to explain the delay, introduces his entire hand in seeking to discover the cause.

FIG. 205.

DIPROSOPUS.

In regard to monsters results are as a rule more favorable if the lower part or parts descend first, and therefore, should the diagnosis be made during labor, podalic version is usually indicated. So, too, podalic version has been successfully done after the spontaneous delivery of one of the heads of united twins, the feet of both twins brought down, and then the bodies, and the head that was unborn delivered.

Of course, the mother's life is of the greater importance, and therefore the obstetrician will have in the case of a monstrosity less hesitation in resorting to mutilating operations upon it. The Cæsarean operation is never indicated for the purpose of saving the life of single or double monstrosity.

[1] Sammlung klin. Vorträge von Volkmann.

FIG. 206.

PYGOPAGUS.

FIG. 207.

DERODYMUS.

Museum College of Physicians, Philadelphia.

FIG. 208.

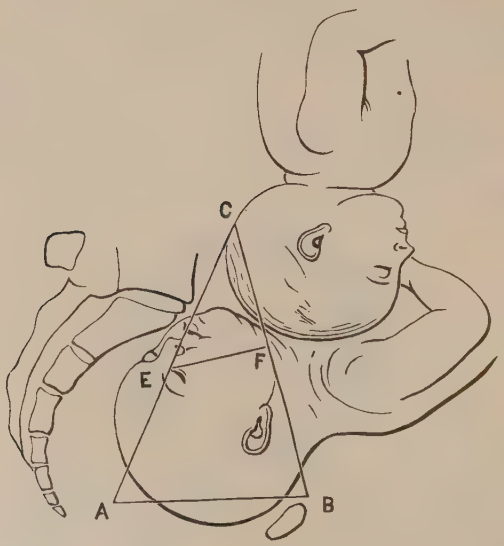
CEPHALO-THORACOPAGUS. Front view. (STERLEY.)

There are two instances of children born with three heads, and in one the child was born alive, and continued to live three days, sucking and crying with each of the three mouths.

Kirchhof[1] describes a thoracopagus found after the death of the mother, in a tubal pregnancy.

Fœtal Anomalies in Plural Labor. Interference of one fœtus with the delivery of the other is a rare complication of twin labors. Among predisposing causes Besson[2] mentions the great size of the pelvis, the small size of the fœtuses, and their occupying a single sac; and among the determining causes the use of ergot, untimely rupture of the fœtal sac, and other interferences with the natural course of labor. This interlocking of the fœtuses may occur in every one of the different varieties of presentations observed in labor with twins. Delay may be caused by both heads presenting at the inlet, but this must be very rare, for Besson gives only one example. More frequently when the heads are first, one descends into the pelvis slightly in advance of the other, then the latter is forced down so that usually the neck of the first child is pressed upon. In some cases the first head is delivered

Fig. 209.



Shows Head-locking, both children presenting Head-first.

spontaneously or by forceps, and then it is impossible to effect delivery of the trunk, or the arrest in labor may come before this. The illustration, Fig. 209 (from Barnes), shows very well this form of interlocking.

In case the first infant presents by the pelvis and the second by the head, the body of the former is delivered, and then the labor stops from the two heads entering the pelvis or coming to its inlet together. One form of this difficulty is presented in the accompanying illustration (also from Barnes). In some cases the head of the second child is fixed

[1] Cent. f. Gynäkol., 1894.

[2] Dystocie spécielle dans les Accouchements multiples.

upon the thorax of the first. When the heads are locked together this may not be, as in the illustration, by the chins, but by the occiputs, or by a chin and occiput, or simply by one side of each head.

When the first child presents by the head, the second by the pelvis, the bag of waters of the former has descended so as to interfere with the transmission of the latter, and the labor been delayed until the obstetrician ruptured the obstacle. Besson quotes a case of this difficulty occurring in the practice of Mauriceau. When both fœtuses present by the pelvis, difficulties may occur from the simultaneous descent of the feet; and in one case of this kind, reported by Armand, the midwife exerted such powerful pulling that she brought away the trunk of each child, leaving the heads in the uterus. Schultze delivered a woman pregnant with twins, four feet and one hand presenting, by drawing upon the feet of the child which was lowest. Cazeaux gives a case from Pleissman, which was probably the first example in which difficult labor from the interlocking of fœtuses was treated by raising the woman's pelvis higher than her chest, a treatment which has within a few years been successfully resorted to by Galbraith[1]—the principle but not the plan used.

"Pleissman states that on one occasion he found the orifice plugged up by the parts that had become engaged, and which at first sight appeared to him to be a quantity of hands and feet. A more careful examination enabled him to distinguish four inferior extremities, which were delivered as far as the ham and one arm." "At first," he says, "I was in great perplexity because I could find no way of introducing my hand into the womb for the purpose of distinguishing and seizing the two feet belonging to each child, and because all my efforts to make even one of these extremities go back again proved abortive; besides which, in drawing any two of them, I might confound them, and bring down the feet of two different fœtuses at the same time; and lastly, even if I succeeded in seizing the feet belonging to the same child, I might, by drawing upon them, engage the other parts, and thus augment the difficulties. Being greatly embarrassed as to the proper course, and yet obliged to act, the employment of a measure suggested by Hippocrates, under different circumstances, happily suggested itself; it was to suspend the patient by her feet, hoping that the heads and bodies of the children would, by their weight, draw one or more of the extremities toward the fundus of the womb, which was still distended by the waters. The husband and brother-in-law of the woman passed their hands under her hams and thus held her suspended, so that only the head and shoulders rested on the bolster. I intended, as soon as I mounted on the bed, to press back one or more of the free extremities into the womb, but two had already returned from the mere position of the mother, and the other three followed by the aid of my fingers. Immediately afterward I was enabled to introduce my hand into the uterus, and to withdraw successively therefrom three children by the feet."

The first child may present by the head and the second be transverse. Jacquemier has narrated the post-mortem condition found in a woman pregnant with twins who died undelivered; the head of the first fœtus was in the pelvic cavity, but the neck of the second was below the shoulder of the first, and formed a half-ring about its neck.[2]

The first child may present by the pelvis, and the second be transverse. Here the feet and trunk of the former may pass the latter, and then the head is arrested by the body which obstructs the inlet.

[1] American Practitioner, 1880, and American Journal of Obstetrics, 1880.
[2] Manuel des Accouchements, tome ii. p. 131.

The last variety given by Besson is that in which the first child is transverse and the second presents by the pelvis. An illustrative case is quoted from Bartscher, in which the feet of the second child were in the vagina, but the hand introduced into the vagina proved that the first was presenting by the shoulder and the second was upon it *à cheval*, that is, a lower limb had descended upon each side of its body.

The treatment of dystocia from interlocking of twins is directed first to saving the mother, next to saving both, and if this cannot be done, to saving one of the twins. The first effort of the obstetrician should be to unlock the head or other parts causing the obstruction. This may be done in some cases by combined external and internal manipulations. Since Galbraith's[1] success, certainly the knee-chest position should be tried. He was called to a case of labor with twins, first child with pelvic presentation, and delivered except the head, which could not be extracted; the second child with vertex presentation. He had the patient take the knee-chest position, while he supported the lifeless body of the partly delivered child. On introducing his hand he found the obstructing head quite movable, and readily pushed it out of the way; In a few minutes the head of the first child was brought down and its delivery effected. If unlocking is impossible—and it may be, in a case in which both heads present—the next step is to apply forceps to the head of the first child and endeavor to deliver it. Barnes advises to have an assistant during this effort apply his hand and push away the second head, but this supposes a very capacious pelvis and a mobile head. Tarnier advises, if delivery cannot be effected by the forceps, and the state of the mother requires action, especially if the child be dead, craniotomy. Decapitation of the first child has been practised by several obstetricians.

Reimann in his paper,[2] "Simultaneous Entrance of Both Heads of Twins Into the Pelvis," mentions, among the number who have performed decapitation under these circumstances, Meigs, and Besson repeats[3] the statement. It may be a matter of no great consequence, but Meigs[4] said expressly that he never saw a case of the kind, afterward stating that one of his "brethren" in Philadelphia did meet with the difficulty "a few years since," and decapitated the first child, when the second was easily delivered.

Reimann lays down the rule that in all cases "the forceps should be applied without delay to the second head; every other measure is unsuitable and useless." This statement seems too absolute.

Considering now those cases in which the first child presents by the pelvis and the seccond by the head (Fig. 210), Barnes states that the first child whose trunk is partly born encounters by far the greater danger, and having discovered that there is but a faint or no hope of saving it, attention should be turned to the best means of securing the second; the wedge may be decomposed by detaching the head of the first, or craniotomy be done. Decapitation of the first child, too, is advocated by Besson. Referring to the rule of most obstetricians to apply the forceps to the head of the second child, a rule which in this particu-

[1] Op. cit.
[2] American Journal of Obstetrics, 1877.
[3] Op. cit.
[4] Op. cit., 3d edition, p. 500.

lar variety of locking of heads corresponds with that which Reimann lays down for all cases, he says that it is irrational. Either the first child is living or it is dead. If it is dead, why not decapitate in order to facilitate the passage of the second, and lessen the pressure which the head of the other child and the soft parts of the mother are undergoing? If it is living, which is very improbable after the trunk has escaped, is

FIG. 210.

SHOWS HEAD-LOCKING, FIRST CHILD COMING FEET-FIRST; IMPACTION OF HEADS FROM WEDGING IN BRIM.

D, Apex of wedge. E C, base of wedge which cannot enter brim. A B, line of decapitation to decompose wedge and enable head of second child to pass.

there any chance of saving it? Craniotomy upon the second infant is to be rejected because it destroys a life which might be saved by other means. Reimann admits decapitation of the first child if the forceps applied to the second does not effect delivery, and if the latter shows distinct signs of life. Now in 34 cases collected by Besson in which the first child presented by the pelvis and the second by the head, there were only 4 in which the former was born living, and therefore because

the probabilities of saving the life of the first are so small, our efforts should be chiefly directed to saving that of the second child, and when the former presents an insuperable obstacle to the delivery of the latter, it should be got out of the way as soon as possible.

Mal-presentation and Complex Presentation. The child presents badly, that is, there is a mal-presentation, when some portion of it descends first which offers such disproportion to the pelvic canal that spontaneous delivery is impossible. The most frequent mal-presentations are those of the shoulder; that is, the child, instead of being longitudinal in the uterus, and one or the other end of the fœtal ovoid lying in the lower uterine segment, is in a position approximating a transverse line, and hence some portion of the side of the ovoid is in relation with the pelvic inlet; but as, in the course of labor, one or the other shoulder ultimately takes this position at the superior strait, the presentation is called by this name. In addition to shoulder presentations, there may be, when the head comes first, a latero-flexion of the head upon the trunk, and hence the side of the head or of the face for a time present. Should this inclined lateral position of the head occur, nature, in almost all cases, rectifies the error, and the position becomes normal.

Dr. Hodge has narrated the case of a primipara, to whom he was called after she had been in labor five days, first under the care of a midwife, and then under that of physicians, and who had been given ergot freely; he found the superior strait "completely occupied by the head of the child, but an accurate diagnosis could not be made, owing to bloody tumors and infiltrations in the presenting part. The blades of the forceps were carefully passed on the sides of the pelvis to the superior strait, and, without difficulty, a firm grasp was made upon the child's head, which, however, was found perfectly immovable. Craniotomy being now determined on, the head was punctured, the forceps, which had not been removed, were now used as compressors, their handles being approximated by means of a strong fillet; the head yielded to this compression, and was gradually brought down and delivered externally. It was now found that it had been originally a presentation of the right side of the head, and that one blade of the forceps was over the face, and the other over the occiput; so that the long diameter of the head had been, by means of the forceps, so diminished as to allow the transit of the head through the outlet of the pelvis, with the face toward one ischium and the occiput toward the opposite. The patient recovered without any special difficulty."

The case just narrated illustrates some of the evil effects of ergot; for, had it not been given, the mal-presentation would almost certainly have been corrected by nature, and the labor probably terminated spontaneously with the birth of a living child. Nevertheless, in case the lateral inclination of the head persists, the indication is plain, as urged by Dr. Hodge, to rectify it by manual means; but in some cases, version or the forceps will be indicated, with a final resort, as in the instance given by Dr. Hodge, to craniotomy.

The management of shoulder presentations will be considered in "Obstetric Operations."

Complex or complicated presentations are those in which two or more unrelated parts of the fœtus—as, for example, the head and a foot or a hand—descend. It is convenient, also, to consider in this connection prolapse of the cord; that is, a presentation of the cord with presentation of some part of the fœtal ovoid, for the same causes which usually produce prolapse of members are also in general those of a similar accident to the cord.

As an illustration of a complex presentation, the following case from La Motte[1] is of interest. On the 27th of October, 1711, he was called to the wife of a carpenter at Montebourg, who had been in labor since the preceding day, and whose child occupied such a position that the *sage-femme* could not explain it. He found the woman very much exhausted, and, upon touching, he distinguished two hands, the head, a foot, and the cord, the last being cold and without pulsation. He introduced his hand, pushing the head away, and carried it to the fundus of the uterus, where he found the second foot; which he drew into the passage, in order to have the two feet together; as he drew the feet out the arm ascended, thus leaving the passage free, and in fifteen minutes the woman was delivered.

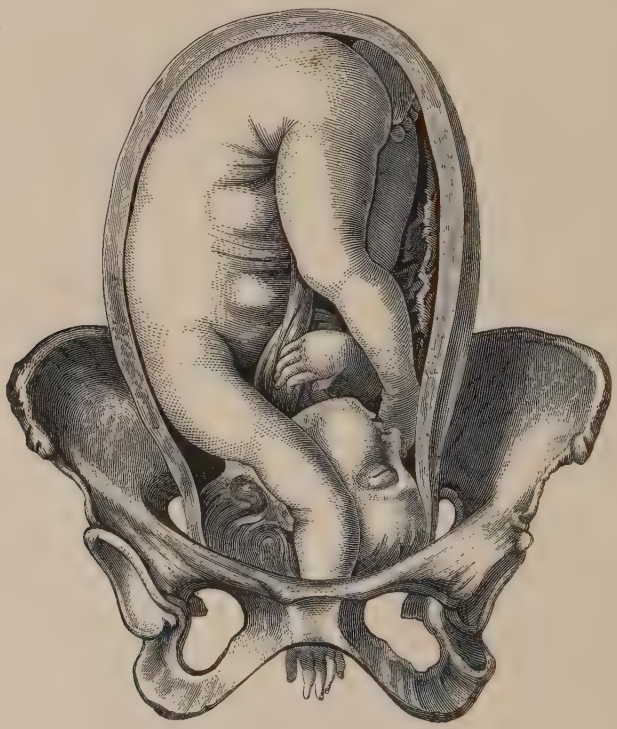
Frequency and Causes of Prolapse of Members. Depaul found in 16,613 labors 163 in which there was prolapse of the members alone or with the umbilical cord; the proportion is, then, 1 to 102. The upper limbs more frequently prolapse than the lower. In some cases a hand or the arm may descend by the side of the head; in others a hand is on each side of the head, or a hand or arm descends with the pelvis. These complex presentations occur more frequently when the vertex or face, rather than the pelvis, presents. In some cases a foot has descended with the shoulder, but the descent of a hand or arm when the shoulder presents does not complicate the presentation any more than the descent of a foot complicates that of the pelvis, since in each case the prolapsed member belongs to the part with which it descends. Madame Lachapelle, and all authors who have written upon the subject since, says Depaul, have admitted as predisposing or occasional causes the small size of the fœtus, the abundance of the amnial liquor, its rapid discharge, oblique presentation of the fœtus—when, for example, instead of being directed in the middle of the superior strait, it is rather directed obliquely toward one of the sides of the circumference of the strait—and, finally, vices of conformation of the pelvis. Charpentier gives, in addition, rupture of the membranes when the woman is standing, and unskilful or untimely attempts to perform version.

Diagnosis. We have not only to recognize the fact that the presentation is complicated, but also the cause of the complication; in other words, know that a member has prolapsed, and what that member is. The diagnosis before rupture of the membranes is usually difficult, and may be impossible. Perhaps a member may be found near the head, and then the former may be pressed against the latter, so that an examination will determine whether it is a hand or foot. In case the head or other presenting part of the fœtus is too high for this to be done, Depaul suggests pressing the member against the pelvic wall, and thus fixing it momentarily for examination. Of course, the probabilities are that a member found near the head is a hand. After the rupture of the membranes the diagnosis is generally easy. Sometimes[2] it is a hand that is applied upon one of the sides of the head, in front or behind, but almost always resting upon one of the parietal bones, and in others it descends lower than the head, and is then readily distinguished. The forearm may be upon the side of the head, as if the child were resting on it. If the pelvis presents, of course we know that the prolapsed

[1] Observation CCXCII. [2] Depaul.

member must be a hand. In some cases this has descended into the vagina, and even projects from the vulva; then there is no difficulty in recognizing what this member is, but there may be in deciding with what presentation it is associated, for it is not uncommon at once to conclude from the hand being in this position that there is a shoulder presentation; but to avoid error the practitioner should always follow up the member until he reaches the presenting part. So, too, if a foot be found in the vagina the conclusion that the pelvis presents is not a necessary one, for the former may have descended by the side of some

FIG. 211.



HAND PROLAPSED BY THE SIDE OF THE HEAD.

other presenting part. A foot seldom descends low in the vagina, and, being larger, delays the descent of the presenting part much more than a hand does.

TREATMENT. In very many cases when a hand or foot is at the side of the fœtal head before the rupture of the waters it is, as it were, pushed up by the descending head, or at least the former is crowded out of the pelvic inlet by the entrance of the latter. Or, again, if the prolapse be slight and space be sufficient, the head comes down, bringing the prolapsed member with it. If descent of one or more members be ascertained before the rupture of the membranes, the patient should lie down, and other precautions be taken to preserve them entire until the os uteri is completely dilated. If the prolapsed member in-

terferes with the entrance of the head into the pelvis, it should be replaced by the hand introduced into the vagina, after which it may be advisable to use forceps, or if the contractions are vigorous it is possible that the entrance of the head into the pelvis, when the obstruction is pushed aside, takes place readily, and its rapid descent will render artificial delivery unnecessary. So, too, in some cases, especially in one like La Motte's, podalic version is indicated. If reduction of a prolapsed member or members fail while the patient is recumbent, an attempt may be made when she is in the knee-chest position.

FIG. 212.

DORSAL DISPLACEMENT OF THE ARM.

FIG. 213.

DORSAL DISPLACEMENT OF THE ARM IN FOOTLING PRESENTATION.

DORSAL DISPLACEMENT OF THE ARM.[1] This has occurred in vertex as well as in pelvic presentations. In the former variety Sir James Simpson, who first described the displacement, advised bringing the arm down, thus making a complex presentation, that of the hand and head.

The following is an extract from a lecture upon La Motte, given by me more than three years ago, and the criticism made by this great practical obstetrician upon Mauriceau's advice is of interest in connection with the observation of Sir James Y. Simpson: In case the hand descended with the head, if the labor was well advanced, and could end without help, La Motte's rule was no interference;

[1] Illustrative cases of this anomaly will be found in Dr. Alexander R. Simpson's Contributions to Obstetrics and Gynecology, and in a paper by Dr. Freeland Barbour, Edinburgh Obstetrical Society's Transactions, vol. xii.

he absolutely rejected any attempt to restore the arm, believing it futile and injurious; if necessary, he performed podalic version. He quoted Mauriceau as stating that in a case of this kind, "I reduced the arm behind the head," and criticised it as follows: "It is not necessary to be a good accoucheur to see that a woman could not be delivered without the arm thus reduced being twisted and broken," etc. Of course, the so-called dorsal displacement of the arm would inevitably result. It is remarkable that Simpson did not mention Mauriceau's advice, and La Motte's criticism.

Playfair thinks it better to perform podalic version, and has done it successfully after having failed to deliver with the forceps. If the displacement occurs in head-last delivery, Barnes advises rotating the child in the opposite direction to that rotation which he believes caused the difficulty. "By rotating the child back in the contrary direction, so as to restore the original position, you may possibly liberate the arm. At any rate, you will render more easy the further proceeding that may be necessary. You carry the trunk well backward, so as to give room to pass your forefinger in between the symphysis pubis and the child's shoulder; and hooking on the elbow draw this downward, and then forward. It may be useful, as a preliminary step, to gain room by first liberating the other arm."[1] Barnes further states that if the arm cannot be liberated, craniotomy may be necessary.

Anomalies of the Cord. *Presentation and Prolapse.* When the cord toward the end of pregnancy is in the vicinity of the os uteri, or descends at the beginning of labor, or only during the period of dilatation, between the presenting part and the membranes, there is said to be a presentation of the cord; the term prolapse is applied to the descent occurring after rupture of the membranes, the prolapse being complete if the cord protrudes from, but incomplete if remaining within, the vagina.

Frequency and Causes. Churchill's statistics show that prolapse of the cord occurred in British, French, and German practice once in 231½ cases. In the Dublin Lying-in Hospital, in 50,061 cases it happened 304 times, or 1 in 168. Charpentier gives the proportion of 1 in 227.

Naegele, in explaining the accident, attributed great importance to the lower uterine segment not being completely occupied by the fœtal part; if this application be perfect, the cord is retained in the womb by the same cause which prevents the flow of all the amnial liquor and only that which is between the head and membranes is discharged. The accident is nearly four times more frequent in multiparæ than in primiparæ. Among other causes usually given are: excess of the amnial liquor, premature rupture of the sac, smallness of the fœtus, face, shoulder, and pelvic presentations,[2] great length and weight of the cord, its marginal attachment, the placenta, being situated in the lower portion of the uterus, oblique position of the uterus, pelvic deformity, and prolapse of one of the fœtal members.

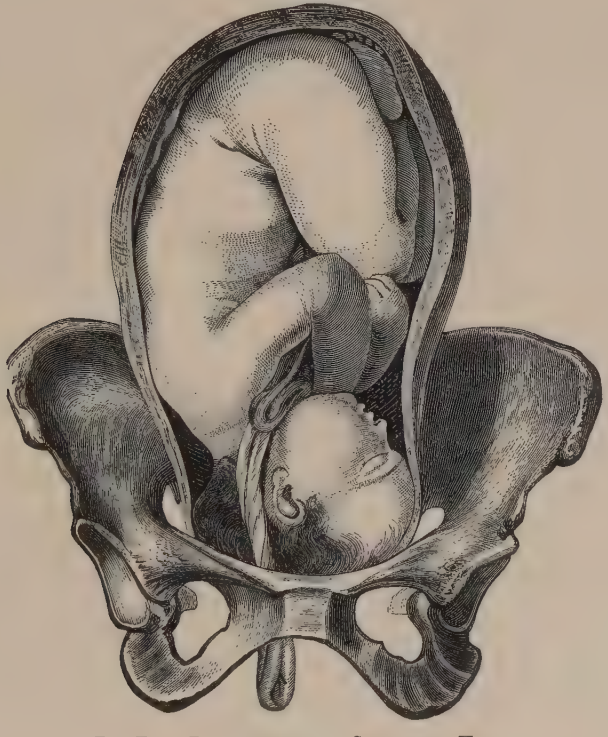
Diagnosis. The recognition of the cord being by the side of the presenting part may be difficult in the early stage of dilatation when

[1] Obstetric Operations.

[2] Massman, quoted by Winckel, estimated the frequency, in head presentations at 1 in 150; in breech presentations, 1 in 21, and in shoulder presentations, 1 in 12.

the membranes are entire; if the cord can be readily touched during the interval of a uterine contraction, its characteristics may usually be determined; it has not the size, shape, or consistence of foot or hand, and beside, it is not suddenly withdrawn as a member often is when touched; possibly by pressing it against a resisting part pulsation may be recognized.

Fig. 214.



The Funis Prolapsed by the Side of the Head.

After the rupture of the membranes, if the cord has escaped from the os uteri, diagnosis is easy, especially if the pulsations can be felt.

The absence of pulsation in the cord does not necessarily indicate that the fœtus is dead, for it may be only temporary; Charpentier delivered a living child by podalic version ten minutes after no beating in the cord could be felt. On the other hand, as observed by Naegele, very often the pressure need be for only a few minutes to kill the fœtus. It is better, in a doubtful case, to listen for the sounds of the fœtal heart.

Prognosis. The accident does not affect the mother, but is very dangerous to the child. Engelmann states that of 365 cases of prolapse 171 of the children, 47.7 per cent., were saved; in foot presentations 71 per cent. of the children were saved; in pelvic, 40, and in vertex, 36.7. Hecker had a mortality of 43 per cent. in head presentations, and in pelvic 17 per cent.; including all cases the mortality

was 37.6 per cent. The statistics of Scanzoni gave a mortality of 55 per cent., and those of Churchill 53 per cent.

Treatment. Formerly it was thought the chief danger to the child occurred from the cord becoming cold in case of complete prolapse—Velpeau, indeed, attributed the danger partly to this—and hence the advice was given to restore it to the vagina or to have it wrapped in warm cloths. Some have held that the arteries only were compressed, and hence the danger was from plethora, while others thought the compression affected the vein exclusively, and therefore the child was anæmic. But partial compression is rendered impossible by the arrangement of the vessels. It is easy to understand that compression of the umbilical cord in suppressing hæmatosis causes asphyxia in the same manner as during extra-uterine life; suffocation, strangulation, or pulmonary embolism determines death in suppressing respiration.

Recognizing the danger of death, we endeavor to avert it by preventing pressure upon the cord. If presentation of the cord be recognized in the first stage of labor, the woman should be lying down, and great care taken to preserve the bag of waters unruptured until this stage is completed.

After the rupture of the membranes if the cord prolapses in front of the child's head, and thus the life of the fœtus be endangered by pressure upon it, the advice given by Smellie still remains the best. He said: "If the navel-string comes down by the child's head, and the pulsation is felt in the arteries, there is a necessity for turning without loss of time; for, unless the head advances first and the delivery is quick, the circulation in the vessels will be entirely obstructed, and the child consequently perish. If the head is low in the pelvis, the forceps may be successfully used."[2] McClintock, in a note upon this passage, has stated that of all modes of treatment recommended, the most successful, as regards the child, is turning. "Thus of sixty-four cases, in the practice of La Motte, Mauriceau, Lachapelle, Boivin, Giffard, and McClintock, when turning was resorted to solely on account of the funis presenting, fifty-two of the children were born alive."

It happens in some cases that after the membranes have ruptured, and the cord prolapses so as to be subjected to pressure, the head is expelled so rapidly there is no necessity for applying the forceps, the cord being compressed for so short a time that there is no risk to the child.

Prior to the rupture of the membranes turning is not indicated if the cord presents, for we do not know that after the discharge of the amnial liquor it will certainly prolapse so as to suffer compression.

Replacement of the Cord. Neither turning nor the forceps being employed, we may endeavor to, partially at least, protect the cord from pressure by putting it in that part of the pelvis where the most room is found, and that will be opposite one or the other sacro-iliac joints according to the position of the head. But it is better in most cases to replace the cord, and this reposition may be manual, instru-

[1] Depaul. [2] Op. cit.

mental, or postural. Mauriceau directed that an effort should be made to carry the cord by the fingers of one hand behind the head, and keep it there until the latter had descended, so as to prevent its prolapsing again; he added that a compress might be placed between the head and the uterus, to sustain the cord after it was replaced. For Mauriceau's compress other obstetricians substituted a sponge, and still others sought to put the cord around one of the fœtal members. Dr. William Harris, of Philadelphia, in a presentation of the breech, returned the cord over the knee, and the child was saved.[1] Boër thought so unfavorably of manual reposition because of the fact that generally the cord prolapsed again and again after repeated replacement, that he compared it to the task of the Danaïdes.[2]

In consequence of the liability to prolapse again after manual replacement, various repositors, that are designed not only to facilitate the replacement, but also to prevent the recurrence of the accident, have been devised. A simple and long-known method is to attach a piece of whalebone, or an elastic bougie or catheter, to a small bag or purse, into which the cord may be placed, and then be restored. As soon as the head descends, the whalebone or bougie may be safely withdrawn.[3] A repositor may be improvised of an ordinary rubber catheter and stylet, with a piece of tape or string. A loop of the tape or string is passed into the eye of the catheter, and the stylet then introduced so that it holds the loop; the cord is fastened by the free ends of the tape, and by the catheter carried into the uterus as far as desirable, and the stylet withdrawn. Charpentier speaks favorably of the following method used by him successfully in one case: "The cord is encircled by a loop of silk, and the ends tied so that the cord will be firmly held but not compressed; the ends are now firmly fastened around the end of an olive-shaped elastic or wax bougie; the cord is now carried within the uterus until the lower end of the bougie is at the os. The bougie is left in the uterus, there is no tendency to recurrence of the prolapse, and the instrument excites uterine contractions, and thus hastens, which is always desirable, the termination of the labor."

Nearly two hundred years ago a famous Holland obstetrician, Deventer, advised the position on the knees and elbows in the treatment of prolapse of the umbilical cord: "The advantages of this position have been shown in later years, especially by Ritgen, Kiestra, Thomas, and Theopold."[4] Winckel states that he has never used the knee-chest position, and has never failed to replace the cord. This position, if maintained for some time, is quite wearisome, and certainly causes the uterine force to act at a great disadvantage. Deventer also advised a lateral position in the treatment of prolapse of the cord; and Galabin states that if the patient cannot be readily induced to adopt the knee-elbow position, the semi-prone position may be used from the first with almost as much advantage.

Even when the pulsations in the cord are feeble and separated by long intervals, hope of saving the child should not be abandoned; the less near the end of pregnancy the longer the child survives interference with the circulation. But when no pulsation has been discovered for fifteen minutes, examinations being made in the intervals of contractions, it may be concluded the fœtus is dead, and the delivery conducted without reference to its interests.

Shortness of the Cord. Brevity of the cord may be absolute or accidental, the latter resulting from circulars around the body, or mem-

[1] Hodge, op. cit.
[2] Depaul used the same apt comparison. Recently an able and distinguished writer deserts the Danaïdes and seeks Sisyphus. No one has yet called upon Hercules, or upon Briareus.
[3] Hodge.
[4] Schröder.

bers. While examples of either form are rare, so rare that a few obstetricians have doubted the existence of this anomaly, yet instances are not wanting to prove the fact, *e. g.*, Rigby saw a case in which the cord was only two inches; Werner, less than four inches; Malgouyre, a little more than two inches. Of course, the site of placental attachment and the place of insertion of the cord must be considered in the question of shortness; and thus the cord must be longer to permit the delivery of the child if the placenta is at the fundus than in the lower portion of the womb, longer too, if the insertion of the cord be central than if it be at the inferior margin of the placenta. Negrier states that the genital canal at the time of fœtal expulsion is 22 centimetres (8.69 inches) and, therefore, Lamare asserts that the cord becomes too short if less than 25 centimetres (9.87 inches).

The diagnosis of brevity of the cord is from lingering labor, not otherwise explained, slight flow of blood immediately after a contraction, depression of the uterus at the place of placental attachment during a contraction, and great recession of the presenting part when the contraction ceases. King, who has given much study to the subject and written several valuable articles upon it, regards as an important sign the strong desire of the patient to sit up, and "the judicious Denman" advised, if labor was delayed from this cause, that the patient should stand or kneel by the side of the bed, or sit upon the lap of one of her assistants.

The dangers from shortness of the cord are, delayed labor, rupture of the cord, premature detachment of the placenta, and inversion of the uterus.

Delivery by expression is regarded as preferable to extraction with the forceps, and, after the child is partially born, should delay result from a tense cord—then only can a certain diagnosis be made—this is to be cut.

Abnormal Resistance of the Bag of Waters. As very thin membranes have as their consequence premature rupture of the bag of waters, so if these membranes are very thick and resisting rupture may be delayed, and partial placental detachment occur, especially if the quantity of amnial liquor is small. The remedy for this condition, of course, is artificial rupture.

CHAPTER IX.

INJURIES OF THE MATERNAL SOFT PARTS.

Injuries of the Vulva. Tears involving the nymphæ sometimes occur in natural as well as in instrumental labor; one of these organs may be divided longitudinally, or partially detached from its base. There may be a tear involving the inferior margin of the vestibule, and it may extend upward to the side of the clitoris, possibly involving the corpus cavernosum, or it may be prolonged inward by the side of the urethra. In some instances, especially if the corpus cavernosum be injured, the bleeding is great; indeed, cases of fatal hemorrhage from such injuries of the vestibule have been reported.[1] If hemorrhage is observed following the birth of the child's head, the body being undelivered, it must necessarily come from an injury of the vulva.

Arrest of hemorrhage can generally be accomplished by compression, but it would be better, should a serious tear be found, to use catgut stitches; so, too, such stitches may be used in tears of the nymphæ for the purpose of preventing deformity of the part; moreover, the more completely closed these wounds are the greater the protection of the patient from infection, for if an injury be external or near the exterior, there is more danger of the absorption of poison than if it be high up in the vagina or of the uterus.

In addition to the stitching, the injured parts may be freely dusted with iodoform; so, too, in cases in which sutures are not used, a similar application should be made.

Tears of the Perineum. According to Olshausen, unavoidable tears of the perineum occur in at least 15 per cent. of primiparæ. Winckel confirms this statement. The former regards tears of the perineum in multiparæ as generally preventable.

Rents of the perineum usually begin at its anterior margin in the median line, and are divided into partial and complete; by the latter is meant a tear which extends through the anal sphincter. In some cases, however, the tear begins in the vagina on one side of the posterior column, and thence passes obliquely to the median line and ends in a tear of the perineum. A superficial rent involves only the skin and subcutaneous fascia. A rent beginning with the expulsion of the head may be increased by the shoulders.

The accident is more liable to occur in old primiparæ. The perineum has sometimes been torn by the introduction of the hand to perform podalic version. To the forceps must be attributed a large number of

[1] Young: Transactions of the Edinburgh Obstetrical Society, vol. viii., gives two cases of tears of the vestibule followed by serious hemorrhage seen by him; one of the patients died from the bleeding.

complete ruptures of the perineum. Thus Leopold and Wehle[1] state that in 105 cases of this injury the forceps had been used in 70.

The majority of obstetric authorities hold that, as a rule, a torn perineum should be stitched as soon as practicable after the injury, or, at least, that the operation be not delayed longer than sixteen hours. When performed immediately it arrests hemorrhage, which, in some cases, is considerable; in all cases an early operation lessens the danger of septic infection taking place through the raw surfaces; and though an incomplete rent that seems great at first become comparatively small in the course of three days, yet spontaneous restoration is not the rule, while restoration is, after perineorrhaphy, and, therefore, this ought to be done unless there are some strong contra-indications.

The stitches can be introduced most conveniently with the patient lying upon her back, and her hips near the edge of the bed. A hot antiseptic vaginal injection is first used, the parts being thus thoroughly cleansed and oozing of blood lessened; an antiseptic tampon of gauze or of cotton is placed in the vagina to prevent uterine discharge from obscuring the field of operation. Supposing the rent to be incomplete, the obstetrician, after threading his needle, which may be curved or straight according to his preference, with silkworm-gut—other material may be used, silk, wire, horsehair, if the first-mentioned be not at hand—introduces one or two fingers of the left hand into the rectum; then with the right hand enters the point of the needle half an inch from the margin of the tear at the lowest part of the latter, on the one side, and carries it across, buried beneath the tissues, unless the tear be complete, in all its course, until it emerges at a corresponding point upon the opposite side; in case the tear be complete, the needle will be entered into the tissues a little below the anal rent—so as to secure the torn fibers of the sphincter—and, carried across, appears in the median line, as does the following suture, and then passes out on the opposite side at a similar point to that in which it was introduced. After placing the first suture, the second and then the third are introduced—rarely will a larger number be necessary; in some cases only one is required. The sutures are then tied, or, if of wire, twisted. Of course, instruments, sutures, and the hands of the operator are properly antisepticized; the silkworm-gut is rendered more pliable by being first soaked for a few minutes in very hot water. In some cases it is necessary before stitching to cut away loose shreds of tissue. If the tear extends up the recto-vaginal wall, internal stitching will be required before employing the external sutures, the material for the former being catgut, and a curved needle being used for the suture, which, as a rule, should be continuous; so, too, let similar suturing of the vaginal surface be made. Finally, the perineal stitches are placed.

After-treatment. By some it is held important to tie the knees together, to use the catheter at regular intervals, and to keep the bowels confined for a week or more. By no probable movement of the limbs can there be any strain upon the perineal tissues now sewed together—tissues that have undergone the very great stretching in labor—and, therefore, the bandaging of the knees is unnecessary; moreover, the

[1] Geburtshülfe und Gynäkologie, Band ii., 1895.

bandage increases the discomfort of the patient and helps to imprison the lochial discharge in the vagina, and is thus an injury. Hildebrandt objects to the use of the catheter because vesical catarrh is very liable to result, and thinks it better for the urine to be discharged spontaneously, if possible. Once in twenty-four hours the vagina should be carefully washed out with a warm antiseptic injection. On the third or fourth day the bowels may be moved by castor oil or by compound licorice powder, assisted by an enema of warm water or an infusion of flax-seed; subsequently evacuation should be had at least once in forty-eight hours. The diet need not vary from that usually given after labor. The common practice is to remove the sutures in from eight to ten days.

CENTRAL RUPTURE OF PERINEUM.[1] Central rupture of the perineum has occasionally occurred, and the head and then the body of the child have passed through this opening, the anterior and posterior portion of the perineum being uninjured; in other instances the rent has been caused by the foot or elbow of the child.

Duncan[2] asserts that the passage of the child through such a rent rarely happens that this is probably sometimes believed in after the event, but is not carefully observed during the process. Reeve[3] has reported a case of central rupture of the perineum, without implication of the vulva, occurring in a multipara. "The rent began on the right side, near the junction of the upper fourth with the lower three-fourths of the labium, followed the outer boundary of the labium downward, and crossed the perineum to the rectum; both the anal sphincters were divided, the laceration extending upward quite an inch and a half. The part of the perineum remaining intact at the posterior commissure and along the lower part of the right labium was about the thickness of a man's thumb." Duncan[4] has called attention to the fact that central perineal rupture may involve only the skin, or the mucous membrane of the vagina, or both of these with their subjacent tissues, while there remains entire some tissue intervening between the skin and the vagina.

Obstetricians agree that if the beginning of a central rupture is observed, the tissues between the tear and the vulvar orifice should be at once divided, thus preventing the extension of the rent into the rectum; but if the injury is not discovered until after delivery, then division of the anterior bridge is not advisable; the tear is to be stitched by interrupted sutures, preferably of silkworm-gut.

INJURIES OF THE VAGINA. It is proposed under this head to consider not only lacerations, but also contused and perforating wounds of the vagina received in labor.

It is convenient to divide these injuries into those of the upper, of the middle, and of the lower part of the vagina. Vaginal tears are frequently associated with corresponding injuries of the uterus. Nevertheless, McClintock,[5] from the statistics of the Rotunda Lying-in Hospital, found 35 of 108 which involved the vagina only, or merely

[1] In the following passage, narrating the labor of Tamar giving birth to twins, we have, according to Luther and some other commentators, medical as well as theological, an instance of central rupture of the perineum: "And it came to pass, when she travailed, that the one put out his hand; and the midwife took and bound upon his hand a scarlet thread, saying, this came out first. And it came to pass, as he drew back his hand, that, behold, his brother came out; and she said, How hast thou broken forth? the breech be upon thee; therefore, his name was called Pharez." (Pharez, it may be added, means breech.) Genesis xxxix.: 28–29.

[2] Transactions of the American Gynecological Association, vol. i. [3] Ibid, vol. iii.

[4] Op. cit. [5] Dublin Journal of Medical Science, May, 1866.

the os uteri with it; it is thus seen that the cases of vaginal injury alone are nearly one-third of the entire number.

Spontaneous tears of the vaginal vault are more frequently transverse than longitudinal, while those in the middle portion of the vagina are generally longitudinal. In some instances the vagina has been, by a circular rent, partially or even completely separated from the uterus. Johnson and Sinclair[1] give the case of a patient in whom a fatal injury of this kind occurred; the woman was a multipara, but delivery being impossible because of cicatrices in the lower part of the vagina, even after division of the cicatricial tissue was made with a bistoury, craniotomy was performed; death occurred the next day. An instance of perforation of the posterior cul-de-sac by a vaginal douche, used to induce labor at the eighth month of pregnancy because of pelvic deformity, is given by Budin.[2] So, too, the vaginal vault has been torn by the badly directed blade of forceps or cephalotribe. Both spontaneous and artificial rents of the upper posterior portion of the vagina are especially liable to occur in case there be a pendulous abdomen permitting anterior displacement of the uterus, for by this displacement the tissues are stretched and thinned. Hart[3] has shown that the posterior vaginal wall is structurally weak at its upper half-inch, while it is more elongated than the anterior wall in labor. Rupture is most common where the posterior vaginal wall is covered by peritoneum, and when it occurs is a tension tear like cervical rupture. Instances of injury to the vagina anteriorly and posteriorly have occurred from the use of the perforator; in one case[4] the practitioner, wishing to open the child's head, made a rent in the bladder, permitting the introduction of three fingers, and in another case[5] the obstetrician, attempting the same operation, thrust his instrument through the tissues, and applied it to the sacral promontory, mistaking it for the fœtal head. Rupture of the vaginal vault has been caused by forcible introduction of the hand into the uterus for the purpose of performing version.[6]

Prolapse of the intestine through the rent has been observed in several cases. Danyau[7] in 1850 collected 17 cases of rupture of the vagina in which the fœtus passed into the abdominal cavity; 4 of these patients recovered. Others, too, have recovered, though the injury permitted prolapse of the intestine. Moysant has reported a case in which a woman being in labor the forceps was vainly applied, and then delivery by podalic version tried; the trunk was extracted, but the head left behind; the woman died in a few hours, and at the post-mortem the fœtal head was found in the left side of the abdominal cavity, having entered through a rent which extended from the uterine junction to the vulva.

Schröder refers to a peculiar case recently reported by Battlehner, of rupture of the anterior vaginal vault with prolapse of the bladder into the vagina.

McClintock[8] gives as the causes of spontaneous rupture of the vagina in the cases which he collected—1, diseases of the vagina; 2, disproportion between the size of the fœtal head and the maternal pelvis; and 3, osseous irregularity upon the inner surface of the pelvis. While, according to the same authority, the recoveries after uterine rupture are only 4½ per cent.; they are after similar injury to the vagina 12 per cent.

The symptoms that have been most frequently observed in ruptures of the vagina are cessation of labor-pains, hemorrhage, recession of the presenting part, which, however, is slight unless the fœtus enters the abdominal cavity; prolapse of intestine or of omentum is a not infrequent complication. Shock, too, has been observed in many cases.

TREATMENT. The treatment is essentially that required in a similar injury to the uterus. Prompt delivery is indicated, and usually this

[1] Midwifery.
[2] Des Lesions traumatiques chez la Femme dans les Accouchements artificiels. Par Pierre Budin. Paris, 1878.
[3] Edinburgh Obstetrical Society's Transactions, vol. viii.
[4] Provincial Medical Journal, 1843.
[5] Budin, op. cit.
[6] Spiegelberg, op. cit.
[7] Bullétins de la Société anatomique, 1857.
[8] Archiv. Méd.

will be made through the vagina; arrest of bleeding will be accomplished by hot-water injections, by sutures, and in only exceptional cases need a tampon, of iodoform or creolin gauze for example, be employed; a lateral rent or one involving the peritoneum usually requires a drainage-tube.

Rents of the Middle Portion of the Vagina. These are generally superficial; they may be caused by careless use of the perforator or of the crochet, or the vagina may be torn by sharp fragments of bones of the fœtal head in extraction after craniotomy. Injury may be done in the introduction of the blade of the forceps, this being forced instead of caused gently to "feel" its way to the desired point; so, too, a tear may be made in the extraction, especially in case the blades are not accurately applied to the side of the child's head and kept in such close relation, for the fœtal head ought to be a protection to the vagina from injury by the borders or by the ends of the forceps blades. Deep tears of the middle portion of the vagina may occur if there be structural change in its tissue, whether from malignant disease or from cicatricial contraction. Contused wounds of the vagina most frequently result from prolonged impaction of the head in the pelvic cavity—and as a consequence subsequent sloughing occurs—which, if involving the anterior wall of the vagina, may result in a vesico-vaginal fistula, or if the posterior, a recto-vaginal fistula.

Treatment. It rarely happens that bleeding from wounds of the middle portion of the vagina is considerable, and its treatment does not differ from that required in similar injury of the upper portion. The most important part of the treatment of the colpitis resulting from the injury will be the use of warm antiseptic injections—1 part of corrosive sublimate to 5000 of water, for example, or a 2 per cent. creolin mixture—and following the injection by introducing an iodoform suppository; if a contused wound involving the anterior wall be present, great care must be taken to prevent distention of the bladder; after sloughing of any part of the vaginal walls, means must be used during the healing to prevent contractions, metal, glass, or hard-rubber dilators being introduced from time to time.

As showing the greater liability to injuries of the vagina in birth in case the child be male, the fact stated by Spiegelberg is significant: that in 12 cases of vesico-vaginal fistula at his clinic and polyclinic, in the labors from which they resulted all the children were boys.

Tears of the Lower Portion of the Vagina. Though these are in most cases associated with corresponding injuries to the perineum or vulva, yet some are not, and therefore should be considered separately. So far as spontaneous injuries of this class are concerned, their most frequent cause is excessive stretching of the vagina; they are usually superficial and situated at or near the median line; in some cases, however, they may have a diagonal course, or two diagonal tears may be united with a median tear, having approximately the form of a Y.

Contused wounds resulting from prolonged pressure by the presenting part are also found here, and they may be followed by sloughing, which may end in rectal or in perineal perforation. Improper use of the forceps is to be credited

with many injuries to the lower part of the vagina; these injuries may result from too rapid extraction, but probably their most frequent cause is turning the handles of the forceps too soon toward the abdomen of the mother, and thus the points of the blades are withdrawn from the child's head and brought directly against the posterior wall of the vagina, making more or less deep furrows in its tissues; a similar accident has occurred from the attempt to withdraw the blades just before the expulsion of the head, a violent pain suddenly expelling the head, while the obstetrician, busy with the manœuvre mentioned, was powerless to prevent the rapid delivery. Dupuy[1] mentions a case in which, the feet presenting, one of these escaped by the vulval opening, while the other, pressing strongly upon the vagina posteriorly, was forced through the perineum. I have seen a somewhat similar case, only the foot inflicting the injury made a rent at the lower portion of the recto-vaginal wall and protruded through the anus, there being also a slight tear in the posterior perineum. Dr. Barker[2] has published a case he was called to in which he found the perineum "enormously distended by the pressure of the head, and the left hand and forearm projecting through the anus." He did not attempt to restore the member, but delivered with the forceps. The patient's bowels were kept confined by opium for ten days, and complete cicatrization followed.

Treatment. Bleeding from uncomplicated lacerations of the lower part of the vagina is usually only slight, and therefore can only exceptionally require means for its arrest. While, too, in most cases these tears are only superficial, and therefore require no treatment other than cleanliness and the use of antiseptics, in others their extent is such that not only to protect from septic infection and to secure their rapid healing, but also to guard against possibly permanent injury to the pelvic floor, sutures are plainly indicated. Properly prepared catgut is the best material for stitching the surfaces together, and the continuous suture is employed.

Thrombus or Hæmatoma of the Vulva or of the Vagina. In addition to the injuries that have been mentioned, there may be tearing of the vessels of the connective tissue of the vulva or of the vagina without external opening, and the effused blood forms a mass known as labial, or vulval, or vaginal thrombus or hæmatoma. This is not a frequent accident. Deneux,[3] in a practice of more than forty years, saw but three cases, and Dubois a like number in 14,000 deliveries. Winckel gives the proportion as 1 in 1600. It is at least relatively more frequent in primiparæ than in multiparæ. Varicose veins are not a predisposing cause; Perrot's statistics, including forty-three cases, show that this condition was present in only two; Barker states that in a very large proportion no such condition preceded the thrombus.

Among the causes of hæmatoma mental emotion, violent vomiting, and coughing have been given. But laying aside this doubtful etiology, we may say with Hervieux that the determining cause of this affection in labor is the prolonged stay of the head in the pelvic cavity, the delay arising from narrow pelvis, from resistance of the perineum, from size of the fœtus, etc., and hence excessive efforts on the part of the patient to overcome the obstacle to delivery. Perrot has shown that there may be a gliding of the vaginal walls upon the peripheral tissues, so that a partial detachment occurs from tearing of portions of the connective tissue, and thus spaces are formed in which blood poured out by the ruptured vessels collects. Or it may be that the walls of vessels are thinned by the great pressure from the fœtus, and when that pressure ceases, a new wave of

[1] Considérations relatives aux Déchirures du Vagin à la Suite de l'Accouchement. Paris, 1822.
[2] The Puerperal Diseases, p. 42.
[3] Maladies Puerpérales, Hervieux.

blood distending them, they give way. According to some authorities, the vessels that rupture are venous, but Winckel says there is no question that the wound of an artery, as well as of a vein, may give rise to a hæmatoma, even though the effusion is most commonly of venous origin. In 35 out of 43 cases collected by Perrot the hemorrhage did not occur until after labor. Dewees[1] has given an instance in which the tumor formed ten minutes after the birth of the first of twins, and was ruptured by the descent of the second child, the patient recovering. Madame Sasanoff, in connection with a case under her care in the Maternity of Kolonna, St. Petersburg, has reported five others[2]—that of Dr. Dewees not being included—as the only ones she could find published in which the hæmatoma formed in the interval between the birth of twins. Of these five, four were fatal. She believes the rule of practice ought to be that, when there exists the least appearance of the formation of a thrombus, the delivery should be hastened, and that to this end version and extraction of the second child should receive a large application, so much the more as the escape of the first child favorably affects the dilatation of the orifice, and facilitates the introduction of the forceps or the hand into the genital canal. If the delivery be delayed, the hæmatoma rapidly increases in size, and rupture or incision may be necessary for the passage of the child, and such early rupture or incision makes the prognosis quite unfavorable.

The tumor varying in size from a hen's egg to a child's head[3] usually appears a short time after labor, but exceptionally several days may intervene. Schröder refers to a case reported by Helfer in which it was first seen on the twenty-first day; in such instances the exciting cause was violent bodily exertion.

Hæmatoma of the vulva is more frequent than of the vagina. The labia majora are oftener affected than the labia minora. The effusion may extend to the connective tissue, making a vulvo-perineal thrombus: "The blood is generally extravasated into the subcutaneous cellular tissue in the perineum between the superficial and median fascia, in the vagina into the submucous tissue, or into the cellular tissue encompassing the vagina; yet there are cases (Cazeaux and Hugenberger) in which it has extended along the vagina up to the peritoneal cellular tissue, and posterior to the peritoneum up to the kidneys, anteriorly in front of the peritoneum up to the navel, and on the sides as far as the sacrum."[4]

The tumor is in the majority of cases unilateral; and its formation is usually preceded by severe pain; the surface is smooth, discolored, livid or violet, and it presents to the touch more or less elasticity with or without fluctuation. If the hemorrhage be great, the symptoms of acute anæmia are present; but death does not follow unless the hæmatoma ruptures, and then it may be very rapid. Recovery generally takes place. Thus Winckel found only six that were fatal in fifty; Barker met with two deaths, both from puerperal fever, in thirteen hospital cases, while of nine in consultation and in private practice all recovered. The prognosis will be governed by the size of the thrombus, and by whether it occurs before or after delivery: the larger the tumor, of course the greater the danger; and, on the other hand, the case is more favorable if the formation occurs after the labor than during it. The termination may be by resolution, and this may happen even if the tumor be as large as the fist, by suppuration, by rupture, or by gangrene.

[1] Diseases of Females: Of Bloody Infiltration in the Labia Pudendi
[2] Annales de Gynécologie December, 1884.
[3] An instance in which the tumor was the size of a child's head, and interfered with the delivery of the placenta, is given in the Centralblatt f. Gynäkol., 1889, p. 526.
[4] Winckel, op. cit.

Treatment. During the formation of a hæmatoma we endeavor to lessen the effusion of blood by the application of an ice-bag and by compression. If rupture occurs, an astringent tampon must be applied and pressure also used. If a hæmatoma appears during labor, and presents an obstacle to the delivery of the child, even by forceps, though such condition is quite exceptional, "incise at once, remove all the clots that have formed, and then deliver by the forceps," and afterward compresses of cotton batting saturated with the solution of persulphate of iron are to be used and pressure made, constitute the directions of Barker. After labor, incision may be rendered necessary by threatened gangrene; but it is always better if this can be delayed for three or four days after the development of the hæmatoma, for, as observed by Schröder, the longer we can wait the less danger from consecutive hemorrhage; nevertheless, Chaussier mentions a case in which the incision was not made for a week, yet hemorrhage occurred, and Baudelocque one in which the opening was not made until three weeks after the tumor was formed, and the following hemorrhage was so great as to require the tampon.

Tears of the Cervix. Lateral tears of the cervix almost invariably occur in a first labor, that upon the left side being usually deeper than the corresponding one upon the right. In some cases the tear extends to the vaginal vault, more rarely above it so that the connective tissue is involved, and still more rarely the injury may reach to the peritoneum. In the multipara some tearing also may occur, but usually the rents are not so deep, and less frequently lateral. The injuries referred to occur not only in spontaneous, but also in artificial delivery, both manual and instrumental; the application of the forceps and extraction of the fœtus before complete dilatation of the os has occurred, as well as rude and hurried dilatation of the os by the hand or rapidly drawing out the child after podalic version, is very liable to cause this accident; when the placenta is prævia, severe and even fatal laceration of the cervix, the tear extending upward to the body of the uterus and downward into the vagina, has been known to result from too rapid dilatation of the os and too hasty extraction of the child.

Lacerations of the vaginal cervix are physiological in the great majority of cases, neither immediately nor remotely demanding professional interference; so far as ulterior consequences are concerned, probably an exaggerated[1] importance has been attached to these injuries of the cervix, more especially in this country, since Emmet has devised the operation known by his name, an operation very beneficial in suitable cases, but often done, as Emmet himself has pointed out, unnecessarily.

In exceptional cases serious hemorrhage comes from the rent in the cervix, and immediate arrest of the bleeding is demanded. This may be accomplished by copious injections of hot water, by the pressure of properly applied iodoform gauze, but the surest means is the suture; for its application the cervix must be seized with suitable forceps, and

[1] Some years ago the late Dr. Holmes pleasantly remarked that Mr. Huxley had given bioplasm about all it could bear. I am quite sure that some practitioners have given a lacerated cervix a good deal more than it can bear. The assumption that healed and innocent physiological tears of the cervix require a plastic operation by which the os and cervix of the woman who has borne a child shall be restored to their condition prior to childbirth, is an error from which originates a great deal of mere carpenter work of no profit whatever except to the operator.

drawn down to the vulva, when the stitches can be readily introduced with the injured part thus exposed; silkworm-gut is the best material for stitches.

Transverse tears of the cervix are comparatively rare. They usually involve only the anterior lip, and then result from its being forcibly held by the descending head against the anterior wall of the pelvis. Schröder refers to the accident as more frequent if there is induration of the cervical tissue; he also mentions a case of Martin's in which there was found a polypoid body formed by the partially detached lip of the uterus.

FIG. 215.

ANNULAR LACERATION OF THE CERVIX.

A few cases of what has been termed annular separation of the cervix have been recorded. This accident results from an unyielding cervix and strong uterine contractions. Barnes[1] refers to a case reported by Gervis in which ring-form detachment was not complete. It was replaced without sutures, as the patient was very prostrate. She recovered, and the ring reunited. Duparcque[2] mentions meeting with a case in which the entire anterior lip was detached, so that at first it seemed as if there were a double os uteri.

RUPTURES OF THE UTERUS. Rupture of the uterus is one of the gravest accidents that can occur to the pregnant or parturient woman, for her child almost without exception perishes, and her own life is lost in the great majority of cases.

FREQUENCY OF RUPTURE. This is variously stated by different authors:

Collins found	1	rupture in	482 labors.
McClintock	1	"	787 "
Bandl	1	"	1183 "
Jolly	1	"	3403 "
Ramsbotham	1	"	4429 "
Von Franque	1	"	3225 "

Winckel saw rupture of the uterus during five years in the Munich clinic in 6 cases out of 4000 labors.

In some instances the rupture is what has been termed "silent," as will be explained hereafter, and the woman perishes of hemorrhage, or of septic infec-

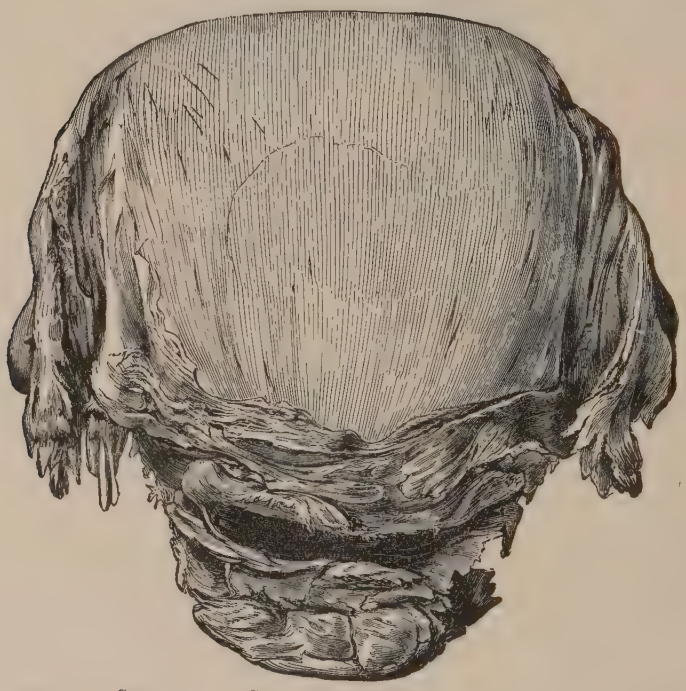
[1] Obstetric Medicine and Surgery. A similar case will be found in the Transactions of the Philadelphia Pathological Society, vol. i., reported by Dr. Keller.
[2] Histoire complète des Ruptures et des Déchirures de l'Utérus, etc.

tion, and only by accident, if an autopsy is made, is the injury known; in the absence of such autopsy death is attributed to one or the other cause mentioned, the true condition being unknown. Hence it is probable the accident occurs oftener than statistics lead us to believe.

Rupture in Pregnancy. This may be spontaneous or result from external violence. The cicatrix remaining after the Cæsarean operation may give way, or the thinned wall of a rudimentary horn yield to the pressure of the growing ovum, or a blow upon the abdomen, or a fall, causes a tear in the normal uterus.

Spontaneous rupture in pregnancy has followed dancing, vomiting, lifting a heavy weight, and great fatigue. Barnes, *op. cit.*, gives illustrative cases.

Fig. 216.



Transverse or Semi-circular Grinding Through of the Uterus. (From Barnes.)

Rupture during Labor; its Causes. In considering the etiology of this accident, it is convenient to refer first to the rarer cases of this accident. Rupture may be consequent upon attrition, the uterine tissue, usually cervical, being forced against abnormal bony projections from some portion of the pelvic inlet, exostoses of pelvic bones; and thus *usur*, a wearing away of those tissues, results. Naegele states that Kilian has drawn especial attention to a deformity of the ilio-pectineal eminence in which this, instead of presenting its normal oval shape, has a spine-like process; similar sharp projections may occupy other parts of the pelvis; to the basin thus deformed the name of *Stachelbecken*, pelvis spinosa, was given; and Kilian showed the injurious effect in

labor resulting from this cause. Depaul has stated that four out of twenty-four deformed pelves in his collection have exaggerated developments of particular parts, forming knife-like projections; according to his observation, this deformity was most frequent at the pubic crest. The following remarkable case is quoted by Duparcque:[1] A woman had been in labor twelve hours, the presentation being pelvic. The os uteri was not yet completely dilated when all the anterior part of the neck, from one side to the other, separated. Immediately the fœtus passed into the abdominal cavity, and it was extracted with great difficulty in less than two hours; it was dead. The mother died five hours after being delivered. The basin was found a little narrow; the point of the sacrum had passed through the posterior part of the uterus (was this the sacro-vertebral angle?); the internal and salient border of the pubis and of the iliac bones resembled somewhat the edge of a paper-cutter, and had cut all the thickness of the uterus as if it had been divided by a ligature. Breus[2] has published a case of injury done to the uterus by its tissues being worn through in consequence of the pressure of the head of the child forcing these tissues against the sharp promontory of a rhachitic pelvis.

Not only may pelvic deformity cause such attrition, but I believe that it may also result from an irregular bony surface of the fœtal body being forced against the uterine walls, hour after hour, by uterine contractions; such a surface is presented by the jagged margin of the imperfect arches of a spina bifida after rupture of the sac has occurred. This belief depends upon my having several years ago, in a judicial investigation, a midwife having been arrested for malpractice, examined the fœtus and the ruptured uterus of the dead mother. The rupture involved the cervix and the lower third of the body of the womb upon the right side; in the labor the pelvis presented with the sacrum to the right, and the most rational explanation of the accident was, to my mind, that which has been stated.

In rare cases no cause can be assigned for the accident. Thus Winckel remarks that the cases of Alexander Simpson and of Hofmeier are very remarkable and difficult to explain. "In Simpson's case the laceration extended from the fundus uteri to the os on the left side; in Hofmeier's the laceration was of the same length, but on the right side; both occurred in pluriparæ and the pains were not very strong; the former showed an abnormal fatty condition of the uterine muscular structure, which was absent in the latter. The most remarkable case of spontaneous rupture of an otherwise normal uterus is, however, the one which Ingersley observed in a 32-year-old VII-para in the eighth month of pregnancy, in whom a rupture from the fundus to within one-half inch of the internal os occurred without any external violence; the child escaped into the peritoneal cavity and the woman died in two hours."

Passing from these rare and exceptional cases, we have now to consider the causes of the accident as it most frequently occurs. So far as immediate causation is concerned, it may be stated that rupture of the uterus is spontaneous or from violence, and this violence may be done by the instrument or by the hand of the obstetrician. Duparcque, in

[1] Op. cit.

[2] Ueber perforirende Usur des Uterus, Wien. med. Blatter.

his well-known work, gives as his first conclusion that ruptures of the uterus in labor are caused by the contractions of the organ. Trask, in his, at the time of publication, exhaustive study[1] of the accident, said: "Unless caused by direct violence, rupture must, in almost every case, be the result of the contraction of the uterine fibres, whether the uterus be healthy or diseased." Tyler Smith expressed the following opinion: "Undoubtedly cases of rupture of the uterus do occur which are dependent upon inflammatory action, either during or before labor, or upon malignant diseases of the uterus; but such cases are rare compared with rupture from self-contraction of the uterus." Jolly stated that the true cause is more or less violent uterine contraction. But contractions of the uterus, though violent, could not rupture the uterus if normal conditions are present, and therefore behind this cause there must be others that predispose or otherwise contribute to the result, and to these our attention will now be directed.

The accident occurs more frequently in multiparæ[2] than in primiparæ, the latter furnishing only 12 per cent. of the entire number. The influence of multiparity is explained by Charpentier as causing thinness of the wall of the uterus and changes in its tissue, with enfeebling of power. Kleinwächter and others, however, believe that healthy uteri rupture more frequently, for they only contract powerfully. Scanzoni suggests the greater frequency of shoulder presentations; to this may be added the greater size of the children. The accident is more frequent in the births of male than of female children—of 67 children, 48 were male, only 19 female. They are more frequent, according to Bandl, among the poor than among the rich.

It is probable that the untimely administration of ergot, or using it in too large doses, must be considered the chief factor in causing rupture of the uterus in some cases. The late Dr. Hugh L. Hodge stated that he had never met with this or seen a case of rupture, with perhaps one exception, in which ergot had not been given. Dr. Meigs has referred to three, and Dr. Bedford to four cases, in which it was believed that ergot was the cause. Similar instances are given by Marot, and it would be easy to increase the list to large proportions, especially if cases were collected from the practice of midwives in this country, who, usually attending cases of labor for low fees, too often endeavor to hurry the labor by giving ergot in the first stage.

The injurious effect of ergot given with a free hand in the first stage of labor can be readily understood when we remember that for the occurrence of spontaneous rupture of the uterus the chief immediate factors are active contraction in the effort to overcome great or insuperable resistance. The undilated or partially dilated os is a barrier to the passage of the fœtus; if time be given, the tissues being healthy, gradually yield and perfect dilatation results; but if the uterus is stimulated to excessive activity the resisting os prevents escape of the presenting part, and the force prematurely or unduly evoked is expended upon the thinned lower segment of the uterus, and rupture follows.

In some cases of pathological change in the cervix, as from malignant disease, rupture follows the vain effort to overcome the resistance.

[1] American Journal of the Medical Sciences, 1848 and 1856.

[2] Playfair states: "Tyler Smith contended that ruptures are relatively as common in first as in subsequent pregnancies." Charpentier says that all authors, except Tyler Smith, admit the influence of multiparity. How these statements can be reconciled with the following language, let others decide: "It is an interesting and remarkable fact that ruptures of the uterus seldom happen to primiparous women." (Lectures on Parturition and the Principles and Practice of Obstetrics. By W. Tyler Smith. Lancet, vol. ii. p. 495.)

It must be remembered that in labor the uterus consists of two portions, one active, the other passive; an upper portion which seeks to expel the child, and a lower portion which is stretched so as to permit that expulsion. Now if, for example, there be a shoulder presentation, expulsion is impossible. So, too, if there be excessive size of the child, as from hydrocephalus, the same element of disproportion between the passenger and the passage is present. Schuchard[1] in 73 cases of uterine rupture found hydrocephalus in 13.

Winckel describes the occurrence of spontaneous rupture as follows:

"Some obstruction, whether it be hardness or rigidity of the external os, or an unusual size of the head (by hydrocephalus), or a faulty attitude (face presentation, prolapse of an arm), prevents dilatation and retraction of the cervix over the presenting part, while it is continually forced by the body of the child under the contraction-ring; hence the lower uterine segment becomes thinner and thinner, until, finally, its fibres separate, by reason of the renewed force of the pains, at the points which have been most tensely stretched and attenuated, the laceration perforating rapidly from within outward."

Symptoms of Threatened Uterine Rupture. The premonitory symptoms are the tense condition of the round ligaments, the great thinning of the lower uterine segment, the ascension of Schröder's contraction-ring, so that from its normal position near the pelvic inlet it may now be only the breadth of two or three fingers below the umbilicus; this ring can be recognized by palpation, and during a uterine contraction can in some cases be seen making a somewhat obliquely lying furrow across the abdomen, while, at the same time, that portion of the uterus below this furrow "is prominent as if it were a distended bladder;" but the use of the catheter will prevent, in a case of doubt, such mistake.

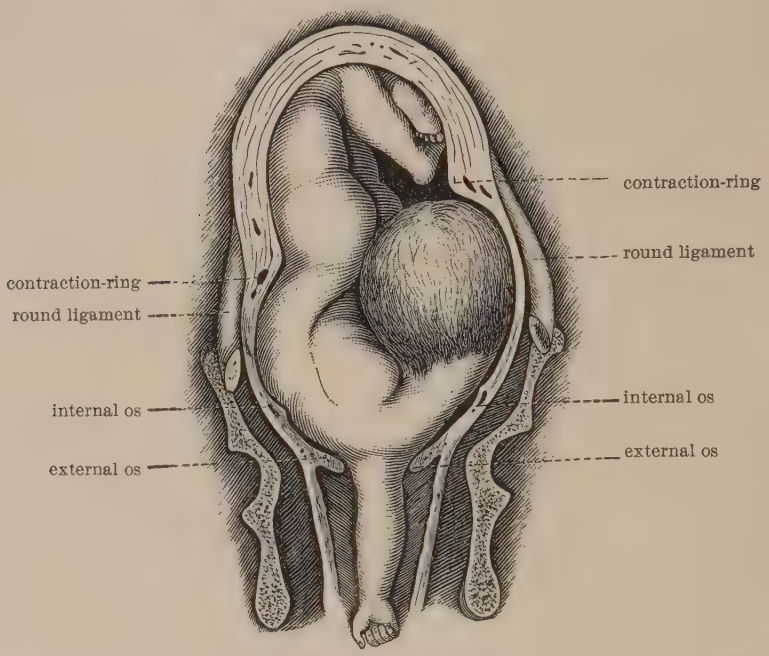
The finger in the vagina passes readily between the presenting part and the cervical wall, which is everywhere found extremely thin. The general condition of the patient also foretells the accident. She is restless and suffers not only during uterine contractions, but also in the intervals; the abdomen is tender;[2] the suffering and the anxiety cause an excited and frequent pulse, and there is some elevation of temperature; her countenance expresses anxiety. Instances of this variety of rupture that do not present premonitory symptoms are quite exceptional.

Tears of the uterus caused by the application of the forceps when the os is not sufficiently dilated, or by the rude and rapid dilatation with the hand, or by the manual extraction of the child in a case of partial expansion of the os, have been previously mentioned. It only remains to refer to this accident in case of threatened rupture in consequence of obstetric manipulations. The shoulder, for example, presents, and the vain labor has continued for hours; the obstetrician performs podalic version, and although accomplished with ease, it may be, as the last straw that breaks the camel's back, so the introduction of fingers or hand, even done with the utmost gentleness, may cause tearing of the uterus.

[1] Ueber die Schweirigheit der Diagnose und die Häufigheit der Uterusruptur bei fötaler Hydrocephalie. Berlin thesis, 1884.
[2] Spiegelberg.

Before mentioning the symptoms of rupture of the uterus, a word may be said of those cases in which there are no indications of the accident.

FIG. 217.



SHOULDER PRESENTATION. THREATENED RUPTURE OF THE STRETCHED LOWER SEGMENT OF THE UTERUS AND CERVIX. (After SCHRÖDER.)

Hervieux[1] narrates a case from the practice of Dubois, in which he performed podalic version on account of narrowed inlet; the woman died the next day, no symptoms of uterine rupture having been manifested, yet there was found at the post-mortem an irregular rent involving a part of the anterior wall of the vagina, the entire length of the neck in front, and a portion of the left side of the uterus. He also refers to a case occurring in the Maternité in his service in which Tarnier by external means changed a pelvic into a vertex presentation; the woman was delivered on the 9th and died on the 11th of November, and at the autopsy there was found a rent in the side of the neck a little more than two inches long, extending from the internal os to the union between the neck and the vagina. In a paper presented some years ago to the Philadelphia County Medical Society, I narrated a case of uterine tear which was not suspected during life, but, the woman dying of septicæmia, a post-mortem showed that there was a complete rent involving the left side of the cervix and the lower third of the body of the uterus. Since that time a medical gentleman of this city brought me the uterus of a woman who died in labor from hemorrhage, so reported, too, in the certificate to the Board of Health, and examination showed that the cause of the hemorrhage was a tear extending from the external os nearly as high as the contraction-ring. Hervieux remarks that in some cases the uterine tear is made silently—neither pain nor complaint nor crisis, and if the patient dies, as is usually the case, one is astonished to find at the autopsy a rupture which had not been even suspected.

Winckel, after referring to these cases, as given in the first edition of this work, adds a similar one occurring under his observation.

[1] Traité clinique et pratique des Maladies puerpérales.

If we add to these silent tears, many of which remain unknown because autopsies in private practice are not frequent, and a few in which death does not follow the accident—those cases which, though recognized by the practitioner, are not made known—it is probable, as has been previously stated, that the accident, though by no means frequent, is less rare than published statistics indicate.

Position and Extent of Tears. Usually the rupture involves the lower uterine segment and the cervix, but it may extend upward into the contraction-ring or downward into the vaginal wall. Usually, too, the peritoneum is torn, so that there is a direct communication between the uterine and abdominal cavities; exceptionally the peritoneum is not injured, and then the rupture is incomplete. The tears are rarely longitudinal, but they may be transverse or oblique; they may be lateral, anterior, or posterior. A part of the fœtus usually enters the abdominal cavity, sometimes almost all or even the entire body; and, on the other hand, a portion of intestine may prolapse through the rent.

Symptoms of Rupture. It may be that during a pain of unusual severity, or an obstetric manipulation, as the introduction of the hand for the purpose of version, the patient has sudden suffering of the greatest intensity, "totally different from the pain of uterine contraction." Trask said that she is conscious of something having given way within her; "she feels a tearing or rending sensation, and in some instances the noise accompanying the rupture is heard by those around her." The last statement is now generally denied; Depaul regarded it as purely theoretical. The patient's face becomes anxious and pale, the skin is covered with cold sweat, there are nausea and vomiting, the pulse is rapid, threadlike, and irregular, the respiration is hurried, difficult, and sighing, the sight is obscured, and there is ringing in the ears. There is severe pain in the abdomen, and the latter notably changes its form if the fœtus has entirely or partially entered its cavity, or if there be large hemorrhage in it. The uterine contractions cease in almost all cases. Upon vaginal examination generally some hemorrhage is discovered, the presenting part has receded, or is replaced by another presentation, and possibly the rent can be at once felt. In the 580 cases studied by Jolly the symptoms narrated were manifested as follows:

Abrupt cessation of contractions	was	observed	in	218 cases.
Gradual " " "	"	"	"	38 "
Change in the pulse	"	"	"	179 "
Prostration	"	"	"	151 "
External hemorrhage, slight in 33,	"	"	"	148 "
Retrocession of presenting part	"	"	"	146 "
Abdominal pain	"	"	"	133 "
Alteration of countenance	"	"	"	115 "
Acute pain at the moment of rupture	"	"	"	62 "
Fœtal parts felt immediately under abdominal wall			in	77 "

These are the signs almost always presented, but others which may occur should not be neglected. Thus a remarkable change in the form of the abdomen is observed—two tumors, one formed by the escaped fœtus and the other by the uterus, may be present. In some cases the movements of the fœtus that have been active suddenly cease, and the sounds of its heart can no longer be heard. Hemorrhage may be external, internal, or both; Charpentier directs attention to the fact that the blood may accumulate at a particular point, forming a hypogastric

tumor. Kiwisch, McClintock, Montgomery, Paully, Ross, Crighton, and Schatz have indicated as a pathognomonic phenomenon the occurrence of emphysema at the level of the hypogastric region, very rapid sometimes, and which results from the penetration of air through the rent and its diffusion in the connective tissue.

But the emphysema referred to can be present only in those cases in which the rent is incomplete. Spiegelberg has stated that the air either enters from without through the tear during intra-vaginal manipulations, or else results from putrefactive changes in the fœtus. This symptom is always a very unfavorable one, all cases in which its presence has been recorded having proved fatal.

Trask made the diagnostic marks two: recession of the presenting part, and the ability to distinguish the limbs of the fœtus beneath the abdominal parietes. In regard to the cessation of the uterine contraction, Jolly found 37 in which this did not occur, or was only temporary, and in some, indeed, the contractions retained their normal force.

Prognosis. This is most unfavorable both for the mother and for the child—especially for the latter. In Jolly's 580 cases only 100 mothers were saved, and of 237 children in regard to whom the results were stated, only 7.5 per cent. were born alive. The mother may die very suddenly from shock, as in a patient of Churchill,[1] who lived but five minutes after the accident, or one of Bluff,[2] who gave a scream of suffering agony, vomited, and died. Instead of sudden death from shock, there may be rapid death from hemorrhage; or a fatal result may occur from strangulation of a coil of intestine in the rent; but the most frequent cause of a fatal termination is septicæmia. In two cases reported by Winckel death was caused by air embolism. The same author regards the prognosis as improved[3] by the use of antiseptics.

While Jolly gave the percentage of recoveries as 17, Spiegelberg thought 5 per cent., the result established by Hugenberger, as being near the truth. Zweifel after quoting Trask as deriving from his statistics that the mortality of expectant treatment was 78 per cent., after delivery by the vagina 68 per cent., and after laparotomy 24 per cent., says these statistics cannot be correct. The suprisingly small mortality when laparotomy was done is to be explained by the fact that cases operated upon which recovered are reported, while the others are passed over, and by the relative smallness of the figures.

Treatment. This comprises that advisable in threatened rupture and that required after the accident has occurred. In the former immediate delivery is demanded, and this must be effected without additional stretching of the cervix. Hence, embryotomy is preferable to version, for the introduction of the hand or fingers for the accomplishment of the latter is liable to cause the accident immediately in such conditions,

[1] Diseases of Women. [2] Siebold's Journal, 1835.

[3] Nevertheless this opinion meets with no support from the statistics of Schaffer, "Uber die Behandlung der Ruptura Uteri mit kompleten Austritt des Kindes." Munich med. Wochenschrift, 1889. He states that of 100 laparotomies for this accident, there were, before 1875, 48 cases with 31 recoveries—65.1 per cent.: antiseptic operations, 52 cases, 19 recoveries—36.1 per cent.

Freund, Central. f. Gynäk., 1892: "The prognosis of uterine rupture has not improved; the chief conclusion of practitioners consists in prophylaxis, early diagnosis, and averting the rupture by proper obstetrical operations, forceps, turning, and in their place, in most cases better, perforation and embryotomy. Cæsarean section only in case of absolute indication.

"After rupture, immediate delivery, when possible *per vias naturales*, and drainage; if the bleeding is severe, not controlled by tampon, if prolapsed and irrestorable loop of intestine, laparotomy and suture as soon as possible."

no additional strain to the overstretched tissues being possible without this injury following. If the child occupies a transverse position, embryotomy; if the head presents in a contracted pelvis, craniotomy; or if there be hydrocephalus, perforation—constitute the treatment advised by Zweifel; and he adds that transverse position, narrow pelvis, and hydrocephalus are almost the sole complications of labor, bringing the imminent danger of rupture of the uterus.

After rupture of the uterus, too, delivery must be made as soon as possible. If the woman is greatly prostrated, stimulants—especially hypodermatics of sulphuric ether—are indicated, and other suitable means employed to bring about reaction. The modes by which delivery is to be effected will depend upon the position of the child, the presentation, and the special obstacle to labor which has been the chief cause of the injury. The child is either in the uterus or in the abdominal cavity, or partly in each. In the first case, supposing the head to present, the forceps or the cephalotribe is indicated; of course, the head is first opened if the latter instrument is employed. If the head be not accessible, delivery by podalic version is indicated. In the third case, still, delivery through the natural passage is the rule if the part of the fœtus that has entered the abdomen can be easily brought into the uterine cavity and without increasing the rent. But if such restoration is impossible without this additional injury to the uterus, and in the second condition that has been stated, abdominal section is required. After delivery through the natural passage, a 3 per cent. solution of carbolic acid is used to wash out the cavity thoroughly, and a drainage-tube introduced. Frommel,[1] pursuing this method, had in 1880 three successful cases, and the next year Hecker[2] reported a success obtained in like manner. Schlemer[3] in 1882 had a case of rupture in which a portion of intestine prolapsed through the rent, the fact of the rent and of the prolapse being ascertained after delivery with the forceps; the bowel was restored, a drainage-tube introduced, an injection of carbolized water employed; the injection was repeated daily, and the woman recovered.

Associated with drainage a compressive abdominal bandage is employed. The drainage-tube is of glass, and is T-shaped; injections are, as a rule, not made through it into the abdominal cavity, but the nozzle of a syringe may from time to time be introduced into the tube, and fluid drawn out; the tube is removed in about a week. Zweifel, after stating that Schröder, Frommel, Gräfe, Hecker, and Morsbach have had excellent results from this treatment, adds that he has also had in his clinic a case that was successful by means of peritoneal drainage.

In a case of rupture[4] reported by Rhinestädter, the peritoneal cavity was washed out through the drainage-tube with a 1 per cent. carbolic acid solution, an antiseptic vaginal tampon introduced, and an ice-bladder applied to the abdomen over the rupture. The vaginal dressing was renewed the next day, the drainage-tube was removed four weeks after the delivery; the woman recovered.

[1] "Zur Therapie der Uterusruptur," Centralblatt für Gynäkol., 1880.
[2] Ibid., 1881. [3] Ibid., 1882. [4] Op. cit.

Fleischman[1] has shown the greater mortality of ruptures of the anterior portion of the cervix than of the posterior, for of 18 cases of the former all died, while of 14 of the latter only 9 were fatal, and he suggests that in the former injury the abdomen should be opened, while in the latter drainage should be used. Douglas's cul-de-sac presents favorable conditions for drainage, while the vesico-uterine does not. In one case successfully treated by drainage the abdominal cavity was washed out with a 1 per cent. thymol solution, and a firm drainage-tube passed posteriorly into the cavity, and retained in position by a loose tampon of iodoform gauze.

Piskacek[2] claims that the most successful treatment for complete rupture is drainage by iodoform-wicking, the results being 12 per cent. better than from laparotomy. Seven cases from Breisky's clinic are given, 5 of them treated by drainage as stated, and 4 recovered. Leopold[3] emphasizes the importance of delivering the child so that the mother's life may be least endangered, and of having especially in view the control of hemorrhage by the promptest treatment. He attaches more value to laparotomy than the previous authority.

Coe, in connection with a case of laparo-hysterectomy successfully done by him for rupture of the uterus,[8] believes this the only method of treatment proper after prolonged and unsuccessful attempts at delivery; he gives a table including 13 cases by different operators, and the maternal mortality is a little more than 69 per cent.

In case laparotomy is done, it should be followed by hysterectomy if the hemorrhage cannot be controlled by suturing the uterine wound, and a tampon of iodoform gauze.

The methods of treating uterine rupture, given by Cholmagroff,[5] are five: *a*. Expectant or antiphlogistic; *b*, laparotomy, the uterus left, and the rent either sutured, or not; *c*, laparotomy with supra-vaginal amputation, or extirpation of the uterus; *d*, drainage of the uterus; and *e*, sutures with, or without introduction of iodoform gauze.

The statistics of Merz[6] show that drainage counts a larger number of successes than any other method. In 75 cases, the expectant plan being pursued, only 10 recovered, that is, 14.2 per cent.; the percentage of recoveries when the tampon was used was 40; after laparotomy, with or without suture, or Porro's operation, 48.1 per cent. recovered, while in drainage with tube, or iodoform material, the recoveries were 66.6 per cent.

R. Braun v. Fernwald, Ueber Uterusruptur, Vienna, 1894, gives 19 ruptures in 38,000 deliveries, that is, 1 in 2000, incomparably more rare in primiparæ than in multiparæ. In the 19 cases not one primipara. Age from 24 to 44 years. Primary laparotomy in 4 cases; 2 rupture sutured, both died. In 2 Porro's operation, 1 fatal, 1 recovery. In 7 cases of complete rupture, the fœtus entirely or partly entering the peritoneal cavity, all died. 19 ruptures, 15 complete, 4 incomplete, 1 complicated with rupture of the bladder; 7 recovered, 36.84 per cent 1 case resulted from high forceps improperly applied.

Hemorrhage After the Birth of the Child. Bleeding subsequent to the delivery of the child may arise from tears at the vaginal entrance, of the vaginal wall, or of the cervix, or it may be from the interior of the womb. The treatment of vulval, vaginal, and cervical hemorrhage has been presented, and there remains now only that variety having its origin in the uterus to be considered.

[1] "Ein Beitrag zur Casuistik der Collumdehnung und der Uterusruptur," Zeitschrift für Heilkunde, 1885.

[2] See abstract of Piskacek's paper in the American Journal of the Medical Sciences, November, 1889.

[3] Archiv f. Gynäkol., 1889.

[4] New York Medical Record, 1889.

[5] Zeitschrift f. Geburtshülfe und Gynäkologie, 1894.

[6] Zur Behandlung des Uterusruptur. Arch. f. Gynakol., Band 45.

This hemorrhage is from the placental site, and, of course, is impossible as long as the placenta is completely attached, but may occur in case of partial detachment. It may occur when the placenta is partially expelled, lying in the vagina, for example, or after its complete expulsion, an hour or more subsequent to the labor.

The essential cause of hemorrhage is deficient uterine contraction. The reason for this failure may be previous excessive distention, as from a plural pregnancy, or from polyhydramnios; or it may be too rapid a labor; the uterus suddenly emptied of the fœtus does not contract as promptly as if the labor had been of normal length, and, on the other hand, a prolonged labor may exhaust the power of the uterus; the liability of albuminurics to post-partum hemorrhage has been previously stated, while hæmophilia is too obvious a cause to be more than mentioned.

In some cases of uterine fibroids retraction of the uterus is hindered, but bleeding will not result unless the site of the placenta has happened to correspond with the situation of one of the tumors.

Hemorrhage after the birth of the child is not a frequent, and in almost all cases is a preventable accident; it generally indicates some sin of omission or of commission on the part of the obstetrician. Spiegelberg has said: "I certainly do not exaggerate when I say that severe post-partum hemorrhage is almost without exception the fault of the attendant. The value of his services can be estimated by the frequency with which this accident occurs in the labors he conducts."

That the accident is not frequent is shown by the following statistics given by Herman:[1] Guy's Hospital, 1 case of dangerous post-partum hemorrhage in 2040 labors; St. Thomas's Hospital, 1 in 2172; and in Prussia, according to Hegar, 1 in 3131.

Veit[2] states that since Dührssen recommended packing the uterus with iodoform gauze, he has sought to ascertain how often atonic bleeding occurs. In analyzing the statistics of 20,378 births given in seventeen years in the *Charité-Annalen*, the frequency of atony varies from 0 to 25: in all there were only two deaths from atonic bleeding. Further, Veit combining these statistics of births with those of Ahlfeld, Winckel, Derselbe, and of Chiari, Braun and Späth, and Hecker, making 47,765 cases, finds there were only five fatal cases of atonic hemorrhage. Incidentally, it is stated by Veit that in one of the fatal cases packing with iodoform gauze was employed; a similar case is given by Strassman.

Symptoms. There is generally observed an unusual frequency of the pulse, but this increase is possibly only slight; nevertheless its occurrence should put the practitioner upon his guard, even though he finds the uterus at the time nearly normal in size and in firmness. The patient probably complains of great thirst, and she is somewhat restless. But, it may be without any premonitory symptoms, the flow of blood is suddenly manifest, trickling through or down by the side of the bed to the floor; the discharge may be so rapid and great that it is appropriately called flooding, a flood upon which the patient's life is swiftly borne away unless proper measures are promptly used; now she is usually restless, and her arms rise and fall, thrown to this side and to that in a sort of aimless way, and agony of despair; her respiration is

[1] British Medical Journal, 1892.
[2] Zur Pathologie und Therapie der Blutungen unmittlebar nach der Geburt. Zeits. f. Geburts und Gynäkol., 1894.

sighing, and she wants fresh air, and possibly she complains of the darkness of the room, exclaiming, "I can't see!" while a deathlike pallor is upon her face. You put your finger upon her pulse; it is frequent, thready, intermittent; your hand upon her abdomen, and the small hard uterine globe is no longer felt, but there is excessive abdominal distention, and it is often difficult or impossible to define the boundaries of the uterus—a relaxed sac filled with blood.

TREATMENT. If ever there is one time more than any other in the obstetrician's life when he needs to be calm and collected and to put forth prompt and intelligent action, it is when he is brought face to face with post-partum hemorrhage.

In addition to lowering the patient's head and the administration of stimulants and of hypodermatic injections of sulphuric ether, etc., applicable in other cases of bleeding with consequent exhaustion, we use direct means to arrest the bleeding. First of these is uterine compression. The usual method of doing this is to grasp the uterus through the abdomen with one hand, while the other is introduced into the uterine cavity in order that its presence may evoke uterine contraction.[1] Possibly, too, the placenta may still be in the uterus, either free or partially attached; in the latter case the fingers are used, as the uterus lessens in size, to detach it, and in either case to remove it from the uterus at the proper time. Probably the uterus is very sensitive when pressed by the abdominal hand, but this arises from its great distention, and as soon as the organ is emptied the excessive sensibility ceases; possibly the uterus cannot be felt at first by this hand—it is so relaxed that it has lost its form—but then so much the more necessity for prompt action.

Should this means fail in arresting the hemorrhage, compression of the uterus, placed in a position of anteflexion, may be employed. Zweifel says it ought to be possible to stop every atonic hemorrhage by energetic use of this treatment. In it pass two fingers into the posterior cul-de-sac, and press the cervix forward, while the other hand, upon the abdomen, is made to press upon the fundus posteriorly, bringing it also forward as shown in the accompanying illustration.

Compression of the abdominal aorta may be made with the fingers of the left hand, the obstetrician being upon the patient's right side; the abdominal wall is depressed just above the uterus and a little to the left of the median line until the pulsations of the vessel are felt, and then slight pressure with the first three fingers will arrest the current. An assistant will be needed, for the fingers become too tired after twenty or thirty minutes to maintain efficient compression. Compression of the abdominal aorta was probably first advocated by Rüdiger, a practitioner of Tübingen, in 1797. His method was with the hand introduced into the uterus, pressing through its posterior wall. Ulsamer in 1825 introduced the method of pressure through the abdominal wall, and it received the strong indorsement, from personal experience, of Siebold and of Baudelocque. Gros[2] has reported nine cases of puerperal hemorrhage in which it was successfully employed. Zweifel holds—this objection has been made by Jacquemier and others—that it is impossible to cut off by this means all the blood-supply to the uterus, because the spermatic arteries pass off from the aorta above the part com-

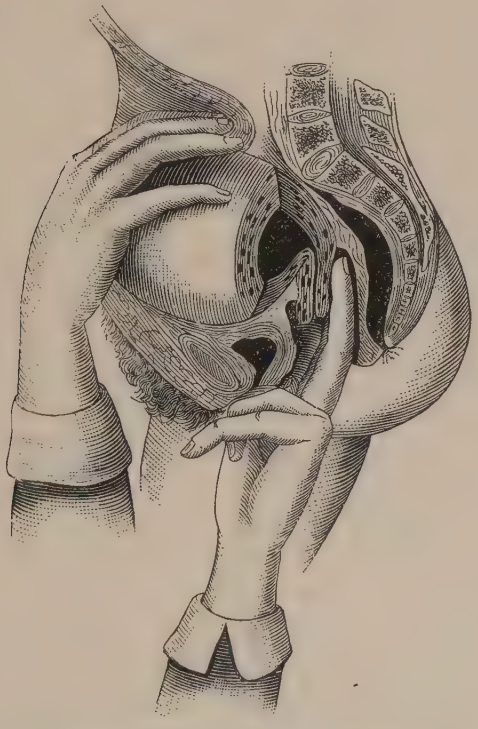
[1] Nevertheless, Veit (op. cit.) holds that never in the first hours is the hand to be passed into the genital canal in treating atony. He further holds that manual detachment of the placenta is an entirely superfluous operation.

[2] De la Compression de l'Aorte dans les Hémorrhages apres l'Accouchement.

pressed, and that the chief benefit is in preventing cerebral anæmia, in this respect being upon the same level as bandaging the limbs, or what is known as auto transfusion.

Uterine contractility has been in some cases evoked by flapping the abdominal wall with a wet towel, by pouring cold water from a height upon the exposed abdomen, by the application of ice to it, by the introduction of pieces of ice into the vagina or into the uterus, or by the injection of cold water into each. In recent years, however, the general preference has been for injecting the uterus with hot, rather than cold water, the former being more efficient than the latter in producing permanent contraction, and stimulating rather than depressing. The water should have a temperature of not less than 105° F., and an irrigator used for its introduction, rather than a pump.

FIG. 218.



ARRESTING HEMORRHAGE BY COMPRESSION OF THE UTERUS IN A POSITION OF ANTEFLEXION. (ZWEIFEL.)

The application of vinegar to the interior of the uterus was probably first advised by Leroux[1] in 1776. Since then many obstetricians have regarded this remedy as of very great value. Dr. Penrose,[2] for example, states that he has been using it alone as his last resort, both in hospital and private practice, in

[1] Observations sur lés Pertes du Sang des Femmes en Couches.
[2] Transactions of the American Gynecological Society, vol. iii.

many apparently desperate cases of post-partum hemorrhage, and invariably with successful results. His method is the following: "I pour a few tablespoonfuls into a vessel; dip into it some clean rag or a clean pocket-handkerchief. I then carry the saturated rag with my hand into the uterus, and squeeze it; the effect of the vinegar flowing over the sides of the cavity of the uterus is magical. The relaxed and flabby uterine muscle instantly responds." Similar stimulating applications have been successfully made to the interior of the uterus—*e. g.*, whiskey. Betz[1] succeeded in arresting post-partum bleeding by introducing into the uterus a sponge upon which chloroform had been poured; and it has been claimed that this agent acts by a powerful excitement of the walls of the vessels either directly or through the vasomotors, and that it is incomparably more energetic than vinegar similarly applied.

A styptic solution of one of the iron salts has been employed with success. There are three ways in which such a solution is used—by injection, by swabbing, and by tamponing. Dr. Robert Barnes has been the especial advocate of the first. The following quotation[2] gives the formula for the iron styptic employed by him and his method of using it: "Solid ferric chloride, ℥j, dissolved in ℥x of water, or the liquor ferri perchloridi (Br. Ph.) ℥jss, water ℥vijss. The rules in using it are: (1) be sure that the uterus is empty of placenta, blood, and clots; (2) compress the body of the uterus by the hand during the injection; (3) have two basins at hand, one containing hot water, the other the ferric solution; pump water well through the syringe—a good Higginson's will do—so as to expel air; then pass the uterine tube into the uterus, and inject first hot water, so as to wash out the cavity and give a last opportunity for evoking diastaltic contraction; then shift the receiving-end of the syringe into the ferric solution, and slowly, gently inject about seven or eight ounces, carefully keeping up steady pressure on the uterus throughout and afterward."

Dr. Wynn Williams[3] has advised applying the iron solution by means of a sponge to the interior of the uterus. He directs pouring some of the tincture of the perchloride of iron into a sponge, which is then passed into the hollow of the hand already in the uterus, clots from the latter having been removed, and then the walls of the uterus are thoroughly sponged over.

Tamponing the uterine cavity with cotton that has been dipped in a solution of the chloride of iron is regarded by Zweifel as only a final resort when all other appropriate means have been vainly tried; and he refers to one case, the only one in which he tried this heroic treatment, that recovered with very slight elevation of temperature. He directs two or three tampons to be dipped in a solution of chloride of iron, and then pressed directly upon the placental site, while external pressure is simultaneously made upon the uterus; if the bleeding still continues, the application is repeated until it stops. He prefers this treatment to injections of an iron solution, stating that he has seen one patient die after such injection, and another recover after the tampon.

Dührssen[4] recommends, in atonic hemorrhage, tamponing the uterine cavity with iodoform gauze, and his recommendation has been followed by many others The gauze is prepared by dipping it in a 20 per cent. iodoform solution; also powdered iodoform is sprinkled on it. Three strips the width of the hand and three metres in length will be used; the cervix is seized with forceps, and drawn down to the vulva, thus exposed to sight, or if not the finger is used as a guide; one end of a strip of gauze, thirty centimetres long, is taken up by forceps, and carried into the uterine cavity; after placing one hand externally over the fundus, the end of the gauze is carried up to the fundus internally, next a fold of the gauze laid over the first, and thus successive layers, like the folds of a closed fan; the second and then the third strip are similarly applied, and the uterus is soon filled, and the organ contracts in consequence of the contact of a foreign body with its mucous membrane. The tampon does not cause suffering; at the end of twenty-four hours it is removed, and there is no trace of decomposition; next, the uterus is washed out with a solution of salicylic acid.

Kaltenbach has spoken of the difficulty of using the tampon if the uterus is

[1] Revue Médico-chirurgicale des Maladies des Femmes, 1886.
[2] Obstetric Medical Society's Transactions, vol. xl. p. 292.
[3] London Obstetrical Society's Transactions, vol. xi. 1870.
[4] Archives de Tocologie, 1887.

relaxed; often the organ remains incompletely tamponed, and the hemorrhage is concealed.

Herman severely criticises the gauze method, stating that we must judge the effect of it rather by the fewness of the failures than by the number of apparent successes; he regards the treatment as neither certain nor safe, and finally condemns it as unphysiological. Some cases in which the tampon failed are given by him, and several others might be added. Time is lost in applying the means, and some hemorrhage during the application is inevitable, while directly the opposite is true in bimanual compression of the uterus.

Undoubtedly the tampon has been employed in many cases in which the hemorrhage was trifling, and hence many of its apparent successes.

Kortüm[1] objects to iodoform gauze on the ground of danger of poisoning, and regards gauze that has been dipped in a 2 to 3 per cent. creolin mixture as in every respect preferable.

Schröder especially directed attention to paralysis of the place of placental insertion as a cause of post-partum hemorrhage, a condition first pointed out by Engel, in 1840; and he urged the importance of large doses of ergot, and, in the worst cases, injection of a solution of chloride of iron to arrest the bleeding.

Schauta[2] refers to extirpation of the uterus by abdominal section as an operation not to be thought of in private practice, but does speak favorably of the proposition of Kocks, to invert the uterus, then encircle the organ with a rubber tube, or with a bandage of iodoform gauze, thus instantly arresting the hemorrhage; after six hours the bandage is removed, and the hemorrhage having stopped the organ is restored. Neither of these methods is to be advised.

Auto-transfusion has upon theoretical grounds and from experience somewhat to recommend it. By bandaging the members so that the blood which they contain is pressed out, and thus contributes to sustaining vital functions, at times imminent death may be averted. But, on the other hand, death may be thus invited, for fatal pulmonary embolism has followed its employment.

Hypodermoclysis. Grenser,[3] and some others, advocate the subcutaneous introduction of a solution of chloride of sodium. Munchmeyer[4] regards it as free from danger, thus differing from intravenous injection, and states that it is not painful. The quantity required will be one litre, the strength of the solution 6 to 1000; it must be sterilized, and the apparatus required for its introduction are a glass funnel of medium size, a rubber tube, and a fine needle; the solution has the temperature of the body, and the parts of election into which it is introduced are the subclavicular and the interscapular regions.

Runge states that transfusion of blood is completely and justly displaced by the infusion of the physiological salt solution. The method has been referred to on page 405.

Secondary Hemorrhage. The subject of hemorrhage in connection with labor cannot be dismissed without briefly referring to a form of this disorder occurring one or more days after delivery during the puerperal period, and which is commonly called secondary. The most frequent cause is the retention of fragments of placenta or of membranes; a placenta succenturiata has in some cases given rise to dangerous hemorrhage.

Several cases have been reported in which the retention of a blood-clot has caused flooding. Ordinarily, the uterus is adequate to the expulsion of clots that may form in its cavity, but sometimes, this expulsion failing, the clot increases in size; the lochial discharge is scanty and serous; the uterus, though

[1] Centralblatt f. Gynäkol., 1887–89.
[2] Die Behandlung der Blutungen post partum.
[3] Centralblatt f. Gynäkol., 1889.
[4] Archiv f. Gynäkol., 1889.

notably increased in size, is firm and resistant; for a time the clot acts as a tampon pressing upon the placental site, and thus prevents hemorrhage. After some days the coagulum spontaneously breaks up, the protecting pressure is at once withdrawn from the open vessels at the placental site, and a hemorrhage which is perilous or may be instantly fatal at once follows. In some instances a uterine fibroid or polypus has been the cause of secondary puerperal hemorrhage. Mental emotion has in several instances produced it. Lactation, sexual intercourse, too early assumption of the erect position or engaging in household duties, the influence of malarial poisoning, and certain displacements of the uterus have been mentioned as causes. Among very rare cases may be stated one reported by Hewitt,[1] of fatal hemorrhage the sixth week after labor from traumatic aneurism of the uterine artery, and one by Johnson[2] and Sinclair, in which death occurred the fourth day following delivery from rupture of a uterine thrombus.

In regard to special treatment of secondary hemorrhage, the importance of removing any foreign body, as a fragment of the placenta or clot, from the uterus is to be borne in mind. In regard to the method of emptying the uterus of a mass of coagulated blood which distends the organ, the fingers, Pajot's curette, or a stream of carbolized water may be employed. During this removal external compression of the uterus is important in order to secure retraction of the organ and thus prevent hemorrhage. The cases are rare in which the uterus is not able to empty itself, but certainly some occur in which direct means must be used for the purpose, and thereby possibly a fatal hemorrhage may be prevented; thus Contamin[3] found, in 6 out of 56 cases of secondary hemorrhage, an intrauterine coagulum the cause.

Ergot will most probably be required in these cases, and often the use of hot water injections will be advisable.

Inversion of the Uterus. Inversion of the uterus is the gravest possible displacement of this organ. Fortunately, it is not a frequent accident, statistics showing that it does not occur oftener than once in one hundred and forty thousand deliveries. An inverted uterus has been compared to the finger of a glove turned inside out; the disorder has been described as a hernia of the uterus through the os; Paré applied the term "perversion" to it, a word which Crosse in his well-known monograph[4] used to designate the final degree of this displacement; if the inversion be complete, the simplest statement of the condition is: the uterus is upside down and inside out.

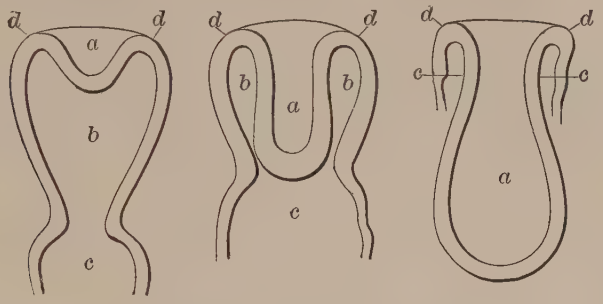
Denuce[5] attributes the first recognition of inversion of the uterus to Hippocrates, who also directed a plan for its restoration; he quotes, too, a passage from Aretæus, who not only described the accident, but also referred to traction upon the cord as one of the causes, this traction being made in an effort to remove an attached placenta; so, too, subsequent great lights of ancient medicine, as Soranus, Moschion, Galen, Paul, of Ægina, and others, have referred more or less distinctly to inversion of the uterus as an accident of childbirth.

Two conditions of the uterus are necessary in order that it can become inverted—increase of the cavity and relaxation, either general or

[1] London Obstetrical Society's Transactions, vol. ix. [2] Practical Midwifery.
[3] Etude sur les Hémorrhagies.
[4] "Essay upon Uterine Inversion." Transactions of the Provincial Medical and Surgical Association, London, 1844 and 1847.
[5] Traité clinique de l'Inversion uterine, Paris, 1883.

local, of the walls. These conditions are presented by the uterus in pregnancy and in labor, but they may also occur if the uterus be dis-

Fig. 219. Fig. 220. Fig. 221.

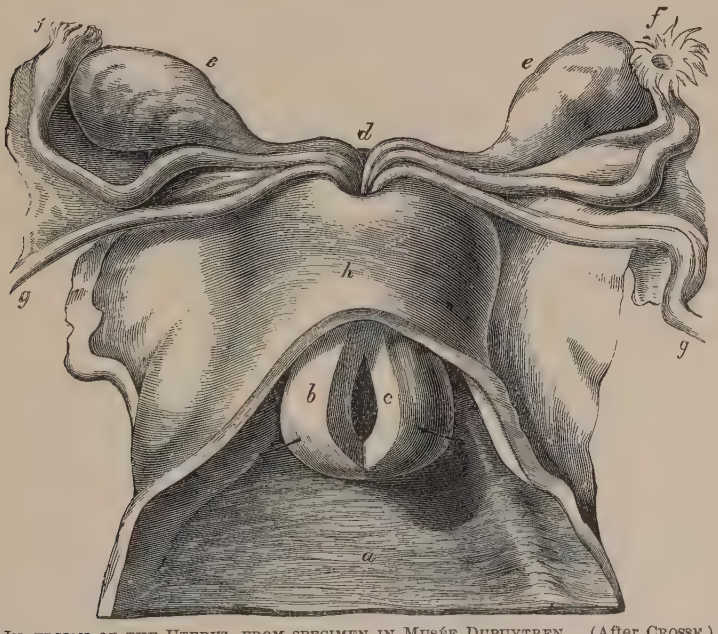


Three Degrees of Inversion. (After Crosse.)

1, depression; 2, introversion; 3, complete inversion; *a*, fundus of uterus; *bb*, cavity of uteri receiving inverted fundus; *c*, vagina; *dd*, mouth of inverted portion.

tended from other cause than an ovum; as, for example, by a polypus. In 400 cases of this accident collected by Crosse, only 50 occurred inde-

Fig. 222.



Inversion of the Uterus, from specimen in Musée Dupuytren. (After Crosse.)

a, vagina; *b*, inverted fundus, incised at *c* to show its cavity; *d*, point of inversion, with round ligaments, tubes, and ovarian ligaments drawn in; *ee*, ovaries; *ff*, fimbriated ends of tubes; *gg*, round ligaments; *h*, cervix covered by peritoneum.

pendently of pregnancy. Most of the 350 thus connected with gestation occurred at its conclusion, only a very few happening after abortion.

In this article the inversion occurring in connection with childbirth, and its treatment, will alone be considered.

The uterus when inverted forms a cavity lined with serous membrane and opening into the abdomen; according to the degree and the recency of the inversion, this newly formed cavity will contain part of the oviducts, of the round and of the broad ligaments, and in some instances the ovaries and loops of intestine. Three degrees of inversion are described. In the first the fundus is depressed, a cup-like cavity being formed, which may be felt from the abdominal wall; in the second the fundus has descended to the internal os uteri, the entire body of the organ thus participating in the displacement; in the third degree the fundus and the body have passed out of the os; in the last case the uterus may pass out of the vulva and be external, the vagina necessarily undergoing partial inversion, and then there is prolapse of the inverted uterus.

Causes of Uterine Inversion. Remembering that the first degree of this disorder consists in a depression of the uterine wall at its upper portion, a cupping of the fundus, as it is sometimes called; this depression may result from intra-uterine traction or from extra-uterine pressure. Either traction or pressure may be spontaneous or artificial; the resulting inversion may be complete or incomplete.

Pulling upon the cord for the delivery of the placenta was, as has been previously stated, recognized by Aretæus as one of the causes of uterine inversion, and probably it is the most frequent cause. The skepticism as to this being common, manifested by one of the wisest of American gynecologists, Dr. Emmet, upon the ground that such delivery of the placenta is so common on the part of ignorant midwives, and therefore the accident ought to be much more frequent, is not well founded. Certain conditions must be present in order that traction upon the cord may invert the uterus, and among these are a firm attachment of the placenta, the site of that attachment the fundus or its vicinity, and uterine relaxation; the usual absence of one or more of these conditions explains the rarity of the accident.

One of the most remarkable cases of uterine inversion caused by pulling upon the cord has been recorded[1] by an American physician, Dr. Woodson, of Kentucky: A negress four months pregnant was taken with severe uterine pains in a bath; she succeeded in seizing the fœtus and dragged it out, inverting the uterus. Relative or absolute shortness of the cord has in several instances been followed in spontaneous delivery by inversion of the uterus. Baudelocque has given two examples. So, also, delivery with the forceps has, in a similar condition of the cord, caused the accident. Illustrative cases are given by Levret and Bockendal.[2] The cord may be normal in length, but from the unusual position occupied by the woman during the expulsion of the child the uterus may be inverted by the weight of the child dragging upon or suspended by the cord. Daillez reported the following case: A girl eighteen years old, near her labor, was driven from home by her her father; she took refuge in the house of a friend, and soon felt the pains of childbirth. An accoucheur called to see her thought that she was suffering from false pains, and went away; upon his return he found her dying, the uterus completely inverted and hanging between her thighs; he learned that the unfortunate girl was delivered standing, her elbows resting upon

[1] American Journal of the Medical Sciences, 1860.

[2] See Denuce.

the back of a chair; the child suddenly escaped and the cord was ruptured. The traction upon the uterine wall may be made by the partially detached placenta and clots of blood; thus, Kormann[1] quotes a case from Dr. Camillo Fürst in which the accident occurred from the weight of a mass of blood resulting from a partial separation of the placenta retained by adherent membranes.

The inversion may be caused by extra-uterine pressure. This pressure may be manual or abdominal. The former may be made in improper efforts exercised to effect the delivery of the placenta by the so-called Credé's method. But abdominal pressure, there being no manual interference whatever, may cause the accident.

Denuce quotes from Galen the following remarkable passage, showing that he recognized this cause of uterine inversion: "Under the influence of the power of expulsion, which is the opposite of the power of retention, of which we have spoken, the mouth of the wound opens, and the entire fundus of this organ so far as possible approaches it, pushing the fœtus out. At the same time as the fundus of the uterus, the parts that surround it, the abdominal walls, which are the external walls of the instrument of expulsion regarded in its whole, pushing by the action of all their forces, strongly clasp the fœtus and force all out. This part of the action, which is under the woman's control, resides not in the uterus, but in the abdominal muscles, which come to her aid as they do in defecation and in urination. Also in some women, when this expulsive power is exerted immoderately, the violent pains may drive out the uterus itself. The accident is entirely similar to that which occurs in struggle or combat, when one of the contestants, forcing the other backward, throws him upon the ground, at the same time falling on him. Thus the uterus, when it violently expels the fœtus, may itself be at the same time precipitated without, especially if the ligaments which fasten it in the basin are previously relaxed."

Paralysis of the placental site or general atony of the uterus is a condition which permits inversion of the uterus by abdominal pressure. Supposing the portion of the uterus corresponding with the place of placental attachment to be paralyzed, there may follow, either with or without abdominal strain, dropping down of this part into the grasp of non-paralyzed but active muscular walls of the uterus; these, therefore, receiving the introcedent mass actively contracting, may make the inversion complete. John Hunter, in describing an inversion of the uterus caused by a polypus, observed: "I conceive the contained or inverted part becomes an adventitious or extraneous body to the containing, and it continues its action to get rid of the inverted part, similar to an intussusception of the intestine." Barnes, in referring to Hunter's description, states that it contains the germ of most subsequent theoretical explanations.

The most recent study of uterine inversion is that by Beckman.[2] His investigation of 100 cases of this accident show that more than one-half of the inversions were spontaneous, and only one-fifth were caused by pulling upon the cord; seven of these occurred in one to five days after labor.

Symptoms and Diagnosis. Pain, shock, and hemorrhage are the chief symptoms of sudden and complete inversion of the uterus. The woman in many cases cries out with the suffering; she may declare, if

[1] Op. cit.

[2] Zur Aetiologie des Inversio Uteri post partum: Z. f. G. und G., 1895.

the inversion occurs rapidly as a consequence of traction upon the cord, that her intestines are being torn away. The shock is partly the expression of this acute suffering, partly the sudden withdrawal from the abdomen of one of its largest organs; and should serious hemorrhage occur, the loss of blood contributes to it. The face is pale, the expression anxious, the pulse frequent and feeble, the limbs cool, and there may be vomiting and also convulsions. The hemorrhage may be slight, for if the placenta be entirely adherent to the uterus there can be no considerable bleeding; if, however, it be completely or partially detached, the flow may be very profuse and prove fatal in a short time. But there may be little or no bleeding, yet the collapse be profound. "Symptoms of incarceration may, and frequently do, arise when coils of intestine have entered the funnel formed by the inverted uterus and have become compressed."[1]

Abdominal examination shows the absence of the uterine globe, and a tumor occupying the vagina, or even chiefly projecting from the vulva, is found. This tumor may have the placenta still attached, and then an error in diagnosis is impossible. If the placenta has been cast off, the obstetrician possibly doubts whether the tumor found in the vagina or at the vulva be an inverted uterus or a polypus, retention of urine being a common consequence of inverted uterus, and a distended bladder may simulate the uterus; therefore, let him who has not witnessed the accident, but who first sees the condition hours or a day or two after its occurrence, begin by using a catheter. No confusion from this cause, and no error in diagnosis thence derived; a bimanual examination, the impossibility of passing a uterine sound into the uterine cavity if the organ be inverted, and ascertaining that the point of a sound passed into the bladder may be felt in the median line by two fingers in the rectum too distinctly to suppose that the uterus intervenes, will leave no doubt in the mind of the careful examiner. I have been called to three cases of inversion of the uterus, and I have not in one of them found the organ the seat of intermittent contractions; yet such contractions have been brought forward as one of the means by which the inverted uterus, can be distinguished from a uterine polypus. So, too, I utterly reject dependence upon the sensitiveness of an inverted uterus as a means of diagnosis; many years ago, in a case of doubtful vaginal tumor, I held in my hand that which by other means was proved to be the inverted uterus, and, watching the face of the patient, made two or three punctures of the tumor with an exploring needle, and not the slightest shade of suffering passed over her countenance coincidently with a puncture. The two signs that have just been mentioned, though indorsed by high authorities, may possibly in some cases be valuable, but, as a rule, I believe they will prove doubtful or even deceptive.

In rare instances inversion of the uterus has occurred some days after labor. It is most probable, however, that in such cases there was already an unrecognized partial inversion, beginning at or soon after delivery, which under the influence of contractions was converted into a complete condition.

[1] Kormann.

Prognosis. Acute puerperal inversion of the uterus is a condition of immediate and great peril. Even though restoration of the organ be promptly accomplished, death may follow, as in a case reported by Breus.[1] Crosse's statistics show that of 109 patients who died, a fatal result occurred in 79 within a few years, in 8 at the end of a week, and in 6 after a month. Crampton's[2] statistics include 120 cases of puerperal inversion of the uterus; and of these 87 recovered, and 32 died. If the unhappy victim has escaped death from shock or hemorrhage, sloughing of the uterus in consequence of constriction by the neck may bring a fatal issue early in the puerperal period. Winckel mentions among causes of death peritonitis, exhaustion, septicæmia, anæmia, pyæmia with abscesses of both ovaries (Hofmeier). Spontaneous restoration of an inverted uterus, even months or years after the accident, has occurred in very rare[3] instances, but the probability of this event is too slight to sustain a rational hope.

Treatment.—Immediate restoration of the organ to its normal place is indicated, and the sooner after the accident the effort is made the greater the probability of success. Supposing the placenta to be still attached,[4] it is first removed, and then the obstetrician grasps the uterus in his hand—antiseptics being used, and, if the patient's condition does not forbid, she is anæsthetized—presses the organ upward, being careful to avoid the sacral promontory, and at the same time with the other hand counter-pressure is made through the abdominal wall; and possibly the fingers of this hand may be usefully employed in overcoming the resistance of the entrance to the uterine cavity now opening into the abdomen. The fingers of the hand which holds the uterus may be usefully employed in dilating the external ring-like cervix, while the palm presses the uterus against the internal resisting portion of it. It will be observed that in this manipulation the taxis is peripheral, and the effort is made to restore first that part of the uterus which came out last.

Another mode of restoration is by pressure directly made upon the fundus: this pressure is usually made by the fingers of one hand brought together in the form of a cone: of course, the finger-nails are short; the attempt is made to depress that portion of the uterus against which the fingers push, and thus begin the restoration. The taxis in this case is central, and the part of the uterus restored first is that which came out first. The third method is that first suggested and successfully employed by Noeggerath, and consists in pressure upon one side of the uterus at a point corresponding with the entrance of an oviduct, indenting or depressing the surface there, and thus starting the restoration; this method has been called that of lateral taxis.

After the restoration of the uterus by one or the other of these plans, the hand, of course being in the uterus at the completion of the reduc-

[1] Wien. med. Woch., 1882.
[2] American Journal of Obstetrics, 1885.
[3] Schütz: Centl. f. Gynäk., 1892, states that ten cases of spontaneous reinversion are known.
[4] Obstetricians are not agreed as to whether the placenta should be removed, provided no separation has begun, before restoration of the inverted organ is attempted. The argument in favor of its removal first is that this can be much more readily accomplished before than after the reduction, and that reduction will be more readily effected without than with the placenta, and that a reinversion is liable to occur in delaying the removal until after the restoration. The argument against it is that thereby hemorrhage is at once caused; undoubtedly, too, we are less liable to injure the uterine walls by pressure with the cone-formed fingers or with the fist, when these walls are in part protected by the intervening placenta.

tion, is used to stimulate, the external hand assisting, the uterus to contract. Barnes says care should be taken to avert what has happened, reinversion, and for this purpose he directs passing along the palm of the hand a uterine tube connected with an injecting syringe and throwing up a pint of hot water, 110° Fahr.

If the physician is not called to the patient until several hours after the accident, or if previous efforts have been made without success, should he at once attempt the reduction? The answer depends upon the condition of the uterus: if it is not inflamed and very sensitive, and if it is relaxed, gentle efforts at restoration may be made even though a day or two have passed. Atthill[1] takes the ground that if an effort at reduction has not been made within twenty-four hours after labor, it is better to wait until after uterine involution has been completed before attempting restoration. The reason for this delay is that the uterine tissues during involution are more liable to be lacerated in the manipulation necessary for reduction.

Nevertheless Spiegelberg held that if reposition did not succeed by manual means, the case should be treated as if it were a chronic inversion, the best course to adopt unquestionably being "to exert continuous and steady pressure on the fundus by means of elastic bags. These will probably always have the wished for result, before the puerperal involution of the uterus is complete."

The danger of infection is necessarily so great pursuing the plan advised by Spiegelberg, we believe it should be rejected; it would be safer to follow the advice given by Atthill. In case hemorrhage should occur, which is not probable because of the constriction of the vessels consequent upon the displacement, it certainly can be arrested by the application of an antiseptic gauze tampon, and this may be removed after a few hours, and renewed as occasion may require.

It should be remembered, however, that uterine hemorrhage in these cases is suppressed by lactation, and, therefore, nursing ought to be strictly directed.

[1] Diseases of Women, Dublin, 1880.

CHAPTER X.

OBSTETRIC OPERATIONS.

INTRODUCTORY. Obstetric operations are divided into those done before, during, and after labor. Many in the first class have already been described, *e. g.*, correcting posterior displacements of the gravid uterus, the application of the tampon, etc.

Position of the Patient. This, of course, will depend upon the character of the operation. In the majority of cases she will be on her back, lying across the bed, her hips brought close to its edge. In some instances, however, she must be upon an operating-table, properly prepared for the occasion.

In certain cases, as will hereafter be explained, lying upon one or the other side is advisable. So, too, as has been previously explained, the knee-chest position may be tried in restoring a retroverted or a retroflexed uterus.

Asepsis, Antisepsis. Perfect cleanliness of the operator's hands and instruments and of the external sexual organs and of the vagina is of first importance. Moreover, let antiseptic means be also used. To this end the reader is referred to the topics of subjective and objective disinfection considered in connection with the conduct of labor. Here I shall only say that as an antiseptic for washing out the vagina and bathing the vulva a solution of lysol is sufficient, if used freely; while most operators will hardly think of performing a grave operation without their hands have been disinfected with a solution of corrosive sublimate, in addition to the thorough washing which has been described.

Phênosalyl. There has recently been successfully employed[1] somewhat in France a new antiseptic called *phênosalyl*. The following is the formula for this compound:

Phenic acid	9 grammes.
Salicylic acid	1 gramme.
Lactic acid	2 grammes.
Menthol	0.10 centigramme.

The product is a colorless, syrupy liquid, having an aromatic odor, and readily soluble in water. As a microbicide it ranks next to corrosive sublimate, and its antiseptic power is more than three times as great as that of carbolic acid, double that of lysol, and more than double that of creolin. It has been employed in the proportion of 30 grammes to 1000 of water for washing the hands of the obstetrician, for bathing the vulva, and for vaginal injection. In has no injurious effect upon the skin, as carbolic acid and corrosive sublimate solution frequently have.

ANÆSTHESIA. In the majority of operations an anæsthetic will not be necessary, *e. g.*, in tamponing, bimanual version, etc., and in some it will be forbidden., *e. g.*, acute inversion of the uterus, or in other condition attended with profound shock. Anæsthesia will be necessary

[1] Revue Médico-Chirurgicale des Maladies des Femmes, February, 1895.

in the graver operations, such as Cæsarean section, while it may be optional in applying forceps. Ahlfeld recommends ether as less dangerous than chloroform; it is contraindicated by bronchitis or pneumonia.

Anæsthesia will be essential in overcoming some of the conditions that may occur in labor, as, for example, tetanus, or spastic stricture of the uterus.

Objects of Operating. Some operations are done solely in the interest of the mother, as inducing abortion because of obstinate vomiting; others have their only object in saving the child, as the Cæsarean section in a dying or upon a dead woman; and finally, most are done in the interest of both mother and child.

Induction of Abortion. The arrest of pregnancy prior to the viability of the fœtus is much oftener done with criminal than for therapeutic purpose.

Historical Notice. Artificial abortion was frequent in ancient times, without regard to saving the mother's life. In the Republic of Plato its production is authorized in certain circumstances.[1] Aristotle not only did not condemn the practice, but even "desired that it should be enforced by law when population had exceeded certain assigned limits." Lecky[2] remarks that the general opinion among the ancients seems to have been that the fœtus was but a part of the mother, and that she had the same right to destroy it as to cauterize a tumor upon her body. It seems to have resulted among the Romans not simply from licentiousness and poverty, "but even from so slight a motive as vanity, which made mothers shrink from the disfigurement of childbirth." The practice was avowed and universal. Ploss[3] refers to the prevalence of abortion, both in civilized and savage nations, this prevalence being especially great among Orientals, because of the slight value attached to the life of the fœtus. The maternal instinct, which acts as a check to the crime, is counterbalanced among the Mohammedans by the severe punishment inflicted upon a woman who has an illegitimate child.

Christianity was the most influential factor in revolutionizing Roman sentiment, and to-day is the most powerful protection of the unborn babe. Lecky, after stating that the average Roman in the later days of Paganism thought artificial abortion only a venial crime, scarcely deserving censure, says, "The language of the Christians from the very beginning was very different. With unwavering consistency and with the strongest emphasis they denounced the practice, not simply as inhuman, but as definitely murder. In the penitential discipline of the Church abortion was placed in the same category as infanticide, and the stern sentences to which the guilty person was subject imprinted on the minds of Christians, more deeply than mere exhortations, a sense of the enormity of the crime." Fortunate is that people or that community in which this sentiment prevails, reinforcing civil law, and strengthening the teaching of medical science in regard to artificial abortion when resorted to from any other motive than the salvation of the mother's life.

Kleinwächter states that it appears from the writings of Aspasia, fragments of which have been received through Ætius, who lived in the fifth century, that the ancient Greeks resorted to abortion in narrow pelves. With the extension of Christianity, however, even this form of abortion disappeared, and was only preserved among the Arabs, as we learn from Rhazes and Avicenna. Further reference to this operation is not made. It reappeared in the middle of the seventeenth century, when it was recommended by the famous German midwife, Justin Siegmundin, for placenta prævia; but it seems most probable, notwithstanding Kleinwächter's statement, that she adopted this practice from French obstetricians. It was employed first in England by W. Cooper in 1717, in order to avoid the great mortality of the Cæsarean operation. It was recommended for the same reason by Scheel in Copenhagen in 1799. It was warmly advocated

[1] Jowett's Translation, vol. iii. p. 343. [2] History of Morals in Europe. [3] Op. cit.

by Mende in Germany, 1802, and by Fodéré in France, 1835, and subsequently by Dubois and Cazeaux.

INDICATIONS FOR ARTIFICIAL ABORTION. These indications may depend upon some general disease of the mother, or upon some local disease or deformity, or upon disease of the ovum.

1. Whenever the mother is suffering from disease caused by pregnancy or originating before it, or accidentally occurring during it, which imperils her life, and there is a reasonable probability that she will recover after abortion, it is indicated. Among these diseases may be mentioned the uncontrollable vomiting of pregnancy, and, in some cases, chorea and nephritis.

The question of producing abortion in case of serious retinal disease has been in recent years presented more especially by American oculists. The view held by them is offered in the extract from Dr. Noyes's volume, which will be given in a moment; it will be observed that the author uses the words "premature labor," though abortion is plainly meant. If hopeless blindness is to be the consequence of the continued pregnancy, though the mother may escape eclampsia and the child's life be saved, is abortion justifiable? This is one of the most difficult questions in obstetric casuistry, and its decision must be left to the practititioner, and especially to the woman and her friends. Knowing instances af hopeless, helpless blindness thus originating, my opinion is that abortion is justifiable to prevent this great evil, if the woman and her friends insist upon it.

Noyes says:[1] "Loring published a case in 1882, in which, at his suggestion, premature labor was resorted to to save sight in a woman who, at three successive pregnancies, was the subject of atrophy of the optic nerves, or rather of low neuritis optica. This was successfully done during the third month and achieved the desired purpose. No albumin was found in the urine, yet the lesion was attributed to the kidneys. Howe, Pooley, and Moore have recorded cases wherein the retinal disease was clearly pronounced, and by removal of the fœtus sight was restored. . . . The grave significance of loss of sight as denoting advanced degeneration of the kidneys lends added importance to the situation, and must be considered as arguing in favor of interference. The uræmic state of the blood is dangerous to the life of the fœtus; when it has already caused lesions in the optic nerve and retina of the mother, and with the prospect of convulsions and peril to the mother's life, resort to artificial labor may be abundantly justified. This point in the management of labor must in the future be regarded with more attention than it has received; and because there may be lesions of the nerve or retina without impaired sight, inspection with the ophthalmoscope is strongly recommended for the same prudential reasons which call for the examination of the urine, even though there are no urgent symptoms. Vision may also be impaired with little or no visible lesion."

I asked my friend Dr. G. M. Gould to give me his opinion upon interruption of pregnancy on account of albuminuric retinitis, and the following is his reply:

DEAR DR. PARVIN: The existence of albuminuric retinitis in pregnancy is such a grave symptom, whether as regards the mother or the child, that it would seem as if one could hardly err in immediately ending the pregnancy. In this connection it might be urged that the ophthalmoscopic examination in all cases, even of suspected nephritis, should not be omitted, because it not seldom happens that the eyeground will show signs of the kidney disease before other symptoms are noticed. At all events, whenever the retinal lesions are evident it is high time for alarm, because eclampsia may supervene and the life of the fœtus be endangered from this cause, or the renal disease may so damage the kidneys that nephritis will persist after the pregnancy has been terminated. From the standpoint of the ophthalmologist alone, and looking only to the threatened loss of vision, as if that were the single function to be considered, it might be contended that recovery of useful vision may undoubtedly follow very severe inflammations of the retina and optic nerve. In reality this is a strong argument for inducing

[1] Text-book on Diseases of the Eye, 1890.

premature labor in the extremest cases of retinal injury from the nephritis of pregnancy. If albuminuria has existed without producing any noteworthy symptoms, one may procrastinate according to his judgment, but it would appear clear to me that with the first pronounced symptoms of retinal disease, whether objective or subjective, there remains but one duty for the obstetrician to perform.

2. In case of such obstruction of the birth-canal, either from pelvic deformity or from neoplasms, that a living child cannot be born through the natural passage even if premature labor be induced, and especially if the obstruction be so great that delivery is impossible after embryotomy, the indication for abortion is by most regarded as clear. This much all must admit: that a plain statement of the facts should be made to the pregnant woman, and then let her take her choice between abortion and the Cæsarean section at the end of pregnancy. There is no doubt as to what that decision will be in nine cases out of ten; and certainly, even if embryotomy be possible at the end of gestation, an early abortion will be less dangerous.

3. Certain uterine displacements, such as retroversion or retroflexion, with incarceration, render abortion necessary.

4. Diseases of the ovum may require it. Detachment of the ovum may have occurred, and hemorrhage demands that the pregnancy be ended, or the same indication be presented by cystic degeneration of the chorion.

Among rarer causes for artificial abortion are malignant disease of the uterus, emptying its cavity being done preparatory to extirpation; death of the ovum with delayed expulsion—that is, missed abortion; hypertrophy of the thyroid, hypertrophy of the mammæ (Porro), and sometimes cardiac or acute pulmonary disease.

Lomer[1] presents cases in which the following are given as causes for artificial abortion: 1, retention of the dead fœtus; 2, severe chronic cystitis with obstinate vomiting; 3, obstinate vomiting; 4, obstinate vomiting, the vomiting continued in a severe form for a time after emptying the uterus; 5, eclampsia; 6, grave acute nephritis; 7, chronic nephritis and threatened eclampsia; 8, hydrorrhœa and hemorrhage; 9, anæmia from placenta prævia; 10, purulent decidual endometritis and rigors; 11, melancholia with sleeplessness, emaciation, and nervous cough; 12, intestinal and pulmonary tuberculosis; 13, early manifested and large varices; 14, multiple spinal sclerosis.

In regard to the indication 12, William Duncan,[2] 1889, induced abortion on account of phthisis; Valenta, 1877, and Seidler, St. Petersburg,[3] advocated it early in 1889. It seems to be admitted that it is advisable in laryngeal tuberculosis. But in general the operation does not save, only prolongs the mother's life. Lomer brings a strong argument in favor of interrupting the pregnancy from the statistics of Professor Maragliano, showing that in forty-two pregnant women having circumscribed tuberculosis of the pulmonary apices, 94 per cent. were dead within a year after labor, while in one hundred and eighty-eight analogous cases, the women not becoming pregnant, the mortality in twenty-one months was only 34 per cent.

These statistics are of very great importance, as showing the great evil pregnancy is to a tuberculous woman. But they do not prove that artificial abortion prolongs life in such cases.

[1] Ueber küntslichen Abortus bei Allgemeinerkrankung der Mutter, 1894.
[2] Transactions of the London Obstetrical Society, 1890.
[3] Centralb. f. Gynäkol., 1894.

Prognosis and Means.—The prognosis will depend upon the condition of the patient and the cause rendering the operation necessary; it is generally favorable.

After careful disinfection of the parts, the next step is gradual dilatation of the cervical canal with aseptic laminaria or tupelo tents, the latter the better, or immediate dilatation, the patient being anæsthetized, by means either of solid dilators or those having blades, and then possibly the smallest of Barnes's dilators may be used. Some have introduced iodoform gauze into the cervical canal, removing the packing after twelve or twenty-four hours, and repeating it as necessary; the introduction of a bougie, or partial detachment of the membranes may excite uterine action—puncture of the membranes is not advisable, at least in the earlier months.

After the abortion has begun the treatment will be similar to that given on pages 471–6.

Induction of Premature Labor. Labor is induced prematurely if the continuance of the pregnancy until term would cause serious danger to the mother or to the child; it seeks to save the life of each, not sacrificing that of one for the sake of the other.

The operation was introduced into obstetric practice more than a century ago by British obstetricians, the most famous of them being Thomas Denman: it was sooner and more readily accepted in Germany than in France, and the former country has furnished the most important contributions to the study of the indications and methods for inducing labor.

Indications. Many of these have already been stated in considering artificial abortion. The most frequent of all is a pelvic deformity so great that only a mutilated child can be extracted at term, and yet permitting a living child to be born if premature labor occurs.

Stehberger proposed, and the proposition was indorsed by Spiegelberg and others, that if a pregnant woman is suffering with a disease which will prove fatal before the normal end of pregnancy, premature labor may be induced in order that the life of the child may be secured rather than expose it to the doubtful chance of being extracted alive by Cæsarean operation performed after the mother's death. But can the date of death be foretold with anything like certainty? And can the obstetrician ever be quite sure that the induction of premature labor will not shorten the mother's days? Of course if this operation is ever done, with such indication, the mother's wish, not merely her consent obtained, must be for it.

Pelvic Contraction. In the justo-minor pelvis with a true conjugate of 9 centimeters (3.5 inches), the induction of premature labor is indicated, according to Litzmann. So, too, it is preferable to the Cæsarean operation, Dohrn holds, in the moderately contracted pelvis if the true conjugate is 7 to 8 centimetres. Winckel teaches that in contracted pelves of 8 centimetres and above, we are only justifiable in inducing labor if previous children have died during or as a result of the labor, because they were especially well developed.

The time for inducing labor will be decided by the degree of deformity. If the conjugata vera is 7 centimetres, labor is induced at the comple-

tion of seven months; if $7\frac{1}{2}$, at the middle of the eighth month; and if 8, at its completion; if $8\frac{1}{2}$, at eight and a half months.[1]

Disease of the Mother. This may be one existing prior to pregnancy, and aggravated by it, or it may be directly connected with or consequent upon the gestation, or it may be an accidental malady. Peter held that if gravido-cardiac accidents are attended with great and immediate peril in the pregnant woman, the induction of premature labor is indicated.

Dujardin-Beaumetz[2] states that, "The most serious complications and the greatest danger of death for the mother appear at seven and a half or eight months. In presence of this fact, is the physician warranted in inducing premature labor? Durosier replies in the affirmative, and a great many obstetricians say the same."

Schröder referred to conditions which cause danger of suffocation, thus especially diseases of the organs of respiration and circulation, and mechanical hindrance to respiration in consequence of distention of the abdomen, as giving occasion for premature labor.

Renal disease may be an indication. If this causes great œdema, scanty urinary secretion, and there are symptoms threatening eclampsia, and when appropriate treatment, especially the hot-water bath, does not avert the dangerous indications, labor may be induced: but it ought not be resorted to simply on account of the "kidney of pregnancy." The obstinate vomiting of pregnancy is recognized as justifying the operation in some cases, and a similar statement may be made as to chorea.[3]

Premature labor has been induced, according to the statement of Pippingsköld, in eclampsia with meningitis, croupous laryngititis, mammary carcinoma, and hectic fever connected with pelvic abscess. It was advised by Ferrario in epilepsy, apoplexy, eclampsia, dropsy, pneumonia, and severe hemorrhage.

Habitual Death of Child.—Denman,[4] while recognizing pelvic deformity as the chief cause for the induction of premature labor, also advised it in case of the death of the child near the end of pregnancy, to be done in subsequent pregnancies, and related two instances in which he successfully employed this practice. This indication has been recognized by several eminent obstetricians since, among whom may be mentioned Sir James Simpson; but in recent years less attention has been given to it, some even deny "habitual death of fœtus," and Spiegelberg, excluding all cases in which the cause of fœtal death was organic disease, especially syphilis, from the operation, stated that a successful case must always be regarded as an exception. Winckel takes a broader view, and would not deny the operation even though the premature death is caused by hereditary syphilis.

The following is an extract from a paper read before one of our State medical societies a few years since:

[1] In reference to these rules, variations from them will be presented in considering symphysiotomy.
[2] Op. cit., Diseases of the Heart, translated from the French by Dr. E. P. Hurd.
[3] Berlin klin. Wochen., 1870.
[4] London Lancet, January 4, 1845: An Introduction to the Practice of Midwifery.

"I have induced labor twice, solely for my own and for the convenience of my patients." It is to be regretted that this statement met with no rebuke at the time it was made. When we consider that there is no certain method of inducing premature labor which secures immunity from infection, but increases, though in slight degree, the liability to such infection, the obstetrician is never justified in exposing a woman to this risk for his own or for her convenience.

Barlow, in his *Essays on Surgery and Midwifery*, published in 1822, has as the motto of the essay upon inducing premature labor this line from Horace's *Art of Poetry:*

"Nec Deus intersit, nisi dignus vindice nodus."

This maxim might well be pondered by any one who should for a moment think of imitating the bad practice referred to.

Prognosis.—According to Wyder's statistics, 5 per cent. of the mothers, and 50 per cent of the children, die; Winckel states that of the children born at seven and a half to eight months, only 33 per cent. are actually kept alive.[1]

Means of Inducing Labor.—The question was a very simple one for the obstetricians of Denman's day; they recognized but one method, as indicated by his statement "No person qualified to decide on the propriety of this operation can be ignorant of the manner of performing it, whether it be done with a quill sharpened at the point, or any more formal instrument." He frankly stated that while in some instances labor happened in twelve hours after puncturing the membranes, in others it did not under twelve or fifteen days.

Winckel gives nineteen different methods. Krause's method is that generally preferred. It is the introduction of a flexible bougie between the ovum and the uterine wall; before this introduction the vagina must be well washed out with an antiseptic solution, the hand of the operator must be first made aseptic as well as the instrument; if labor does not come on within twenty-four hours, a second bougie is introduced in a different direction, the first having been withdrawn: great gentleness must be observed in the introduction of the bougie lest the membranes be torn or the placenta be partially detached—it must be made to "feel" its way in. In some cases the uterus may be so anteflexed, or the cervical canal be so contracted, that the bougie cannot be introduced; then a tupelo tent may be first used in narrowed cervix, and also in flexion—in the latter case it can only be passed at first as far as the bend, and great care must be taken not to do any violence by trying to push it further. In all these manipulations an antiseptic injection into the vagina must be made, not only before the introduction of bougie or tent, but also after its removal and inserting a new one.

In case premature labor is induced because of placenta prævia, the Krause method is to be rejected, for the bougie in its introduction immediately causes hemorrhage. Therefore dilatation with tupelo tent at first, then with Barnes's dilators, is to be preferred, or even the doubtful method of tamponing the vagina.

Chenevière[2] has successfully employed the following method: Small iodoform gauze tampons are by means of a thick sound pressed into the cervical canal, and

[1] The results obtained by the employment of the *couveuse* and of *gavage* show a much lower fœtal mortality than above stated.

[2] Revue Médicale de la Suisse Romande, 1889.

somewhat above the internal os, and the canal is also filled, the whole being retained by a large vaginal tampon.

For the purpose of exciting uterine contraction, Kehrer has employed tampons of cotton dipped in glycerin, and then pressed in the cervical canal.

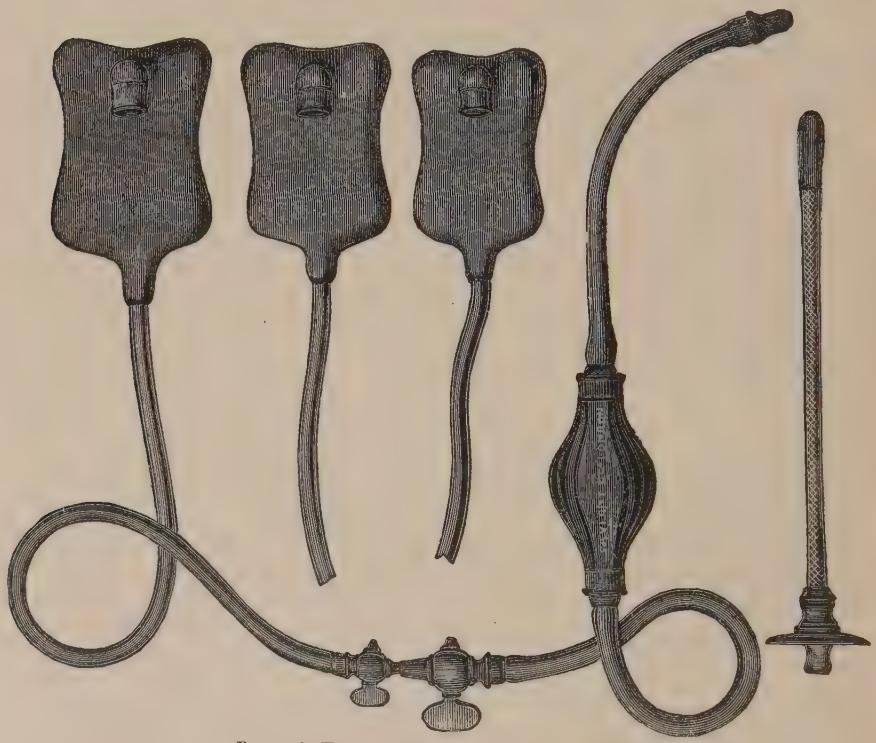
In the Krause method, a flexible catheter is not to be used, but always a bougie, for infection is more liable to occur with the former. The preference given by some practitioners to the Kiwisch method is that by it there is less danger of infection.

Fritsch advises introducing two or three bougies at one time.

One danger from the bougie is penetrating the amnial sac, and another is partially detaching the placenta; if the latter accident should occur, and the bleeding be considerable, a tampon of iodoform gauze will be employed.

The injection of water in the uterus for bringing on labor was recommended by Avicenna. Schweighäuser, in 1825, advised injection of warm water, and Schakenberg, in 1833, employed cold water for this purpose; Cohen, of Hamburg, in 1846, used tar-water. The statistics of Breisky, united with those of

FIG. 223.



BARNES'S HYDROSTATIC DILATORS AND SYRINGE.

Sabarth, show that of 62 cases in which Cohen's method was employed, only 30 of the children were born living. All these methods have been abandoned.

Pelzer, in 1892, employed intra-uterine injections of glycerin. Several obstetricians have followed Pelzer's plan, and usually prompt uterine action has resulted from injecting glycerine between the ovum and the uterine wall. But the method has been condemned by Pfannenstiel in consequence of some deaths following it.

Other methods are by means of Tarnier's dilator, Barnes's rubber bags, the balloon of Champetier, of Riber—an instrument highly recom-

mended by many in ante-partum hemorrhage—tamponing the vagina, hot-water douche (Kiwisch's method), and electricity. The rubber bags of Barnes may be usefully employed to accelerate labor, but not even the smallest to begin it.

One of the evil consequences of using the rubber bags of Barnes, or the bag of Champetier, is that the presenting part of the child may be pushed away and an unfavorable presentation result; thus, in some instances, the head has been replaced by the shoulder.

Grinda, as the result[1] of a study of the different means of inducing labor, recommends beginning with the balloon of Tarnier, and using his dilator as an auxiliary means.

Version, or Turning.—Version is an obstetric operation by which one end of the fœtal ovoid is substituted for the other, or either for presentation of a shoulder. If in this operation the head is made to take the place of the shoulder or pelvis, the version is called cephalic; but if the pelvis takes the place of either of the others, the version is pelvic; and when at the same time, this being more frequently the case, the operator brings down one or both feet, the version is podalic; thus it is evident that podalic is really a variety of pelvic version.

Cephalic Version.—This variety of turning, as the oldest, will be first described, although it has now passed into almost complete disuse. Indeed, so commonly is podalic version employed that to speak of version, or turning, is generally understood as bringing down one or both feet. There are two general methods by which it is performed, each being bimanual, but in one of them one hand is external and the other internal, while in the other both hands are external.

A. Version by internal and external manipulation. The great majority of cephalic versions are performed in consequence of presentation of the shoulder, and generally when the labor has been so long in progress that rectification of the presentation is impossible by external manipulation, and therefore the method of performing cephalic version by one hand internal and the other external must be that which is most frequently employed.

There are several ways of turning by the head, and I shall first describe that of the late Dr. M. B. Wright, of Cincinnati, a method which has received scant acknowledgment even by American obstetricians, and yet it is, as those who have tried it will testify, one of the safest, simplest, and most certain.

The following is Dr. Wright's[2] description of this method as given in 1854: "Suppose the patient to have been placed upon her back, across the bed, and with her hips near the edge—the presentation to be the right shoulder, with the head in the left iliac fossa—the right hand to have been introduced into the vagina, and the arm, if prolapsed, having been placed as near as may be in its original position across the breast. We now apply our fingers upon the top of the shoulder, and our thumb in the opposite axilla, or on such part as will give us command of the chest, and enable up to apply a degree of lateral force. Our

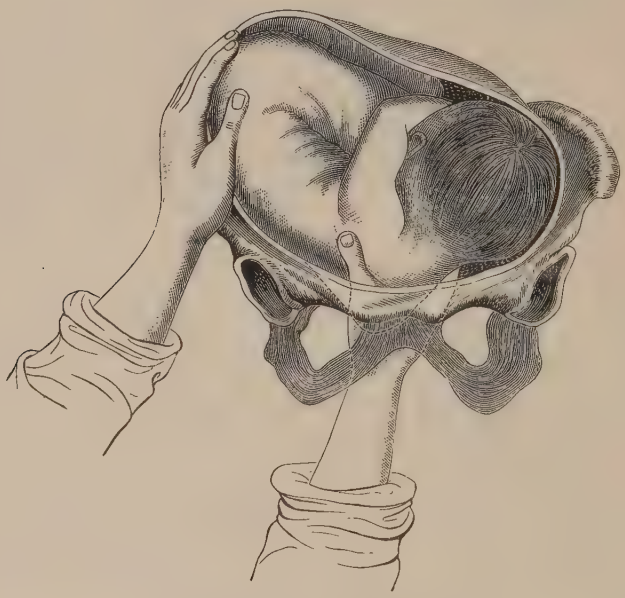
[1] Technique de l'Accouchement prématuré artificiel. Paris, 1891.

[2] Difficult Labors and their Treatment. By M. B. Wright, M.D., of Cincinnati. For which a gold medal was awarded by the Ohio State Medical Society, Cincinnati, 1854.

left hand is also applied to the abdomen of the patient, over the breech of the fœtus. Lateral pressure is made upon the shoulder in such a way as to give the body of the fœtus a curvilinear movement. At the same time the left hand, applied as above, makes pressure so as to dislodge the breech, as it were, and move it toward the centre of the uterine cavity. The body is thus made to assume its original bent position, the points of contact with the uterus are loosened, and perhaps diminished, and the force of adhesion is in a good degree overcome. Without any direct action upon the head it gradually approaches the superior strait, falls into the opening, and will, in all probability, adjust itself as a favorable vertex presentation. If not, the head may be acted upon as in deviated positions of the vertex, or it may be grasped, brought into the strait, and placed in correspondence with one of the oblique diameters." One point upon which Wright insisted as peculiar to his method was that he did not attempt to raise the shoulder, but regarded this manipulation, advised by some obstetricians, as really hindering instead of promoting cephalic version.

He directed that the entire process be done in the intervals between uterine contractions, and that when a vertex presentation was secured the practitioner should be governed as to time and manner of delivery by the general rules applicable to such presentation.

FIG. 224.



CEPHALIC VERSION. WRIGHT'S METHOD.

Dr. Wright first employed his method successfully in three cases in the year 1850. I believe his last published contribution upon the subject was in 1876.[1] In the twenty-six years intervening between the first application of his plan and this time he had frequent opportunities of verifying its value, and often succeeded in cases in which the shoulder was so impacted that others had vainly attempted podalic version. He usually operated with the patient in the position described, but in some difficult cases had her take the knee-chest position.

Three other methods of performing cephalic version by one hand internally, and the other externally, will be given, two of them antedating by many years that of Wright, while the third was not published until some years after it.

[1] American Practitioner, January, 1876.

1. Busch ruptured the membranes, and immediately after passed his hand into the uterus over the occiput and to the nucha so as to exercise a gentle traction during the escape of the waters, and to fix the head in the pelvic inlet until uterine contractions occurred. Coincident with this internal manipulation the other hand was used to act upon the breech through the abdominal wall. 2. D'Outrepont with one hand introduced into the uterus lifted up the trunk of the fœtus, acting upon the presenting shoulder, and with the other through the abdominal wall pressed the head out of the iliac fossa, in which it was resting, and into the pelvic inlet. 3. Braxton Hicks[1] thus describes his method of performing cephalic version:[2] "Introduce the left hand into the vagina as in podalic version, place the right hand on the outside of the abdomen, in order to make out the position of the fœtus, and the direction of the head and feet. Should the shoulder, for instance, present, then push it with one or two fingers on the top in the direction of the feet. At the same time pressure by the outer hand should be exerted on the cephalic end of the child. This will bring down the head close to the os; then let the head be received upon the tips of the inside fingers. The head will play like a ball between the two hands, it will be under their command, and can be placed in almost any part at will. Let the head then be placed over the os, taking care to rectify any tendency to face presentation. It is as well, if the breech will not rise to the fundus readily after the hand is fairly in the os, to withdraw the hand from the vagina, and with it press up the breech from the exterior. The hand which is retaining gently the head from the outside should continue there for some little time, till the pains have insured the retention of the child in its new position by the adaptation of the uterine walls to its form."

B. Version by external manipulation, or external bimanual[3] *version.* Hergott states that the merit of having created this method belongs entirely to Wigand. Wigand held that version by external manœuvres was indicated whenever at the beginning of labor the presentation of the fœtus was abnormal; its purpose was to make a regular presentation; that is, of one or the other end of the fœtal ovoid. When Froriep advised the application of the method in the latter part of pregnancy before labor had begun, Wigand replied that he had several times done it successfully.

The time of operating should be at the beginning of labor or in the latter part of pregnancy, and the preparations are the same as those required for abdominal palpation in the diagnosis of pregnancy. A careful diagnosis of the presentation and its variety is made by palpation and by auscultation, and, also, if labor has begun, by vaginal touch. Upon turning to Fig. 130 it will be observed that the right shoulder is presenting, or would if labor had begun; the back is anterior, and the head is in the left iliac fossa. The operator is upon the woman's right side, and his right hand is placed upon the fœtal head, while the left is applied to the other end of the fœtal ovoid; the arrows indicate the direction in which the two ends of the fœtal ovoid are caused to move, the head descending to the pelvic inlet, the breech ascending to the uterine fundus; when, by the action of the hands in concert, the change

[1] Hicks's first publication upon combined external and internal version was in the Lancet, July, 1860.

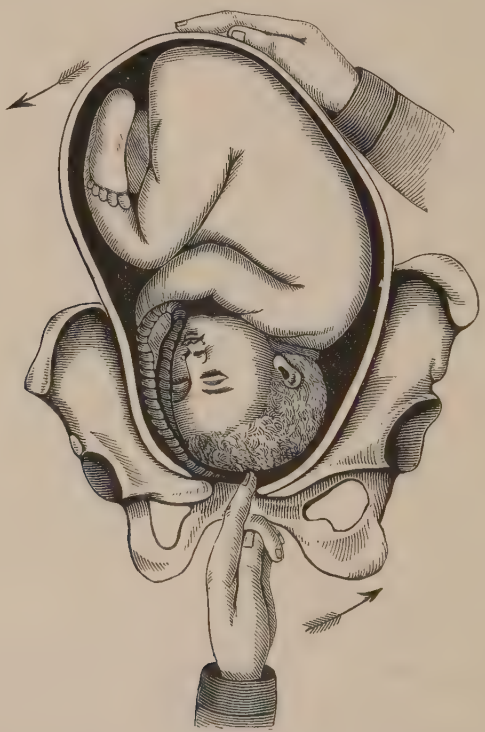
[2] London Obstetrical Society's Transactions, vol. v., for the year 1863.

[3] It seems to me unfortunate that some obstetric writers substitute for this term bipolar, for confusion may thence arise, and moreover the new designation is incorrect, for when in cephalic version by internal and external manipulation the fingers or hand are applied to the shoulder, that is not one of the poles of the fœtal ovoid; or, again, when, as in a part of Hicks's method, just described, the head is made to "play like a ball between the two hands," those hands are not at the poles of the ovoid. There is not a step in the entire process that can be correctly termed bipolar.

in the position of the fœtus has been effected so that the head is at the inlet, Wigand's direction is followed, and she lies upon her left side, that is, upon the side toward which the head was displaced. If labor has begun, again following the direction of Wigand, the membranes are ruptured so that the head will be retained in its normal position by uterine contractions; if labor has not begun, the same object is sought by the application of a bandage; one has been devised by Pinard for this purpose.

Pelvic and Podalic Version. Pelvic version by external manœuvres is indicated, according to Kleinwächter, whenever the pelvis lies nearer the inlet than the head does. It may be done during labor or in pregnancy. The manipulation is similar to that which has just been described as employed in cephalic version. But as a vertex presentation can be secured in the condition just stated with little more trouble, and as this is so much more favorable, pelvic version will rarely be employed.

Fig. 225.



Braxton Hicks's Method of Combined Podalic Version, First Stage.

One or two fingers of the left hand lift the head from the brim and push it toward the left iliac fossa, while the right hand pushes the breech transversely toward the right side.

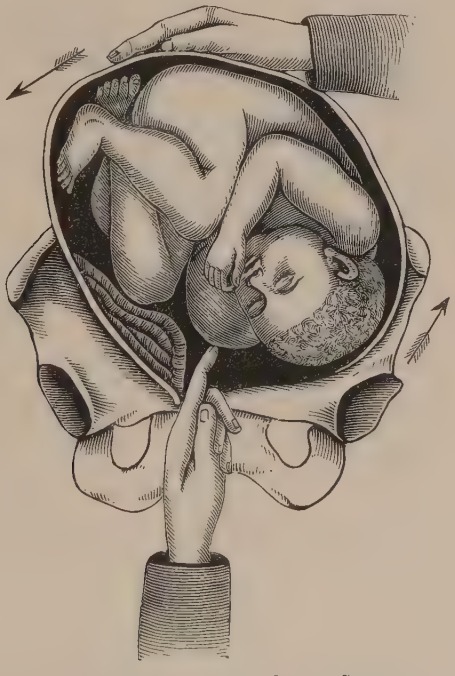
Podalic Version by Braxton Hicks's Method. This method will be presented in the author's words, and with his illustrations.

The patient occupies the left lateral position. The os uteri is sup-

posed to be dilated so that one or two fingers can enter, and the membranes unruptured, and the face toward the right side.

"Having lubricated my left hand, I introduce it as far into the vagina as is necessary in order to reach a finger's length within the cervix—sometimes it requires the whole hand, sometimes three or four fingers will be sufficient in the vagina. Having clearly made out the head and its direction, whether to one side or the other of the os uteri, I place my right hand on the abdomen of the patient, toward the fundus; I then endeavor to make out the breech, which is seldom a difficult matter. The external hand then presses gently but firmly the breech to the right side; as it recedes, so the hand follows it by gentle palpation, or by a kind of gliding movement over the integuments, while at the same time the other hand pushes up the head in the opposite direction, so as to raise it above the brim (Fig. 225).

Fig. 226.



Braxton Hicks's Method, Second Stage.

The left hand pushes the shoulder to the left, while the right hand pushes the breech to the right and downward.

"It may here be mentioned that when the head has descended a considerable distance into the pelvic cavity, or more than half-way through the os uteri, it is scarcely possible to lift it above the brim, especially if the uterus be active.

"When the breech has arrived at or about the transverse diameter of the uterus, the head will have cleared the brim, and the shoulder will be opposite the os (Fig. 226). That is pushed on in like manner at the

head, and after a little further depression of the breech from the outside the knee touches the finger and can be hooked down by it (Fig. 227). It very frequently happens when the membranes are perfect that as soon as the shoulder is felt, the breech and foot come to the os in a moment, in consequence of the tendency of the uterus to bring the long axis of the child coincident with that of its own. Should it, therefore, be difficult to hook down the knee, depress the breech still more, and it will almost always be the case that the foot will be at hand.

FIG. 227.

BRAXTON HICKS'S METHOD.

The right hand forces the fœtal limb down within reach of the left hand, so that the fingers may be hooked over the knee.

"It will sometimes render turning more easy if, as soon as the head is above the brim, we pass the outside hand beneath it, and push it up from the outside alternately with the depression of the breech. All this can generally be performed in a much less time than I have taken to describe it, although in some it requires gentle, firm, and steady perseverance, with such a supply of patience as is always required in obstetric operations."

DIRECT PODALIC VERSION, OR INTERNAL TURNING. This is the method of turning that is most frequently employed. In its consideration there will be presented in order the necessary conditions permitting it, the indications requiring it, and the way in which it is done.

In order that podalic version may succeed the os must be sufficiently dilated to permit the entrance of the hand, the presenting part of the fœtus must be mobile, and the pelvis of a size permitting birth.

The indications for podalic version are, first, unfavorable presentation. Under this will be included not only presentation of the shoulder —probably the condition most frequently requiring turning—but also

presentation of the posterior parietal bone, presentation of the forehead, or of the face, if the chin is posterior, and complex presentations, for example, a member descending with the head, or the umbilical cord; in some instances the indication for turning is absolute, but in others only conditional. In double monstrosities, podalic version will usually be indicated.

Podalic version, whether by direct or indirect method, is indicated in certain dangerous conditions for mother or child, *e. g.*, in accidental or unavoidable hemorrhage, in compression of a prolapsed cord, when delivery can thereby be more promptly accomplished.

Finally, podalic version is employed in cases of flat pelvis in certain conditions. On page 508 this turning is referred to as advisable when the head fails to engage. But, in addition, prophylactic turning has been advocated by many obstetricians as the proper treatment in this deformity of the pelvis, and Kaltenbach has added to the flat pelvis the obliquely distorted pelvis.

Of course, this was the method of treating delayed and difficult labor long ago; but it is especially to the investigations and the writings of the late Sir James Y. Simpson that general attention has been directed to the subject in this century.[1] According to Sir James, not merely was the child a cone, the feet being the apex, and the arch or biparietal diameter the base, but also the head itself was cone-shaped, the base of the skull considerably narrower than the arch, the bimastoid diameter being notably less than the biparietal, "so that the cranium increases gradually in breadth and size, like the whole body, from below upward."

Accepting this view, it is obvious that if the head comes last the narrowest part of the cone enters the narrowest part of the pelvis first, while the broadest part of the former will follow, at the same time its diameter diminished by the overriding of the parietal bones. Further, it is regarded as favorable that the body of the child furnishes an "excellent handle" for extracting the child, drawing the head through the contracted brim.

The cases adapted for prophylactic turning are, according to Runge, those in which the os half, or more, dilated, the head remains still above the brim, the patients having previously had difficult labors, or given birth to dead children —turn in these, and deliver as soon as possible. In order that this may be done the fœtus must be movable, and the amnial liquor not long discharged. Acting in these conditions, many children will be saved that would be lost in cranial presentation. Of course, the prognosis for the child is more favorable the less the pelvic contraction. "In a conjugate of 7.5 cm. and under, one will not always certainly succeed in drawing the head through the narrowed part without injury."

In performing podalic version the patient lies across the bed, legs flexed, and feet resting upon two chairs. Of course, careful antisepsis, both subjective and objective, is employed: usually anæsthesia. The operator sits, or he may be standing, between the patient's limbs, and introduces in the vagina that hand the palm of which corresponds with the abdominal plane of the fœtus, the hand being in a conical form for introduction; it is turned so that the dorsal surface rests upon the posterior vaginal wall; the conical form necessary for introduction is no longer kept, and the hand is passed up to the mouth of the womb; in case the membranes have not been ruptured this should now be done, for the practice once advised by some obstetricians not to do this until the hand

[1] Obstetric Works, vol. i.

has ascended so far in the womb that a foot can be felt, presents no real advantages and exposes to some dangers both immediate and remote; of course, the more completely the amnial liquor is retained the more readily version is accomplished—"it is like turning a body floating in a bucket of water"—but if the hand enters the amnial cavity immediately after the rupture, it acts as a plug and prevents the escape of any considerable amount of fluid. The search for the feet or for a foot is facilitated by the action of the free hand externally pressing upon the uterus, keeping it in one position, and especially by pushing toward the internal hand the pelvis of the child. In this search two methods have been proposed, the one known as the German and the other as the French; in the former the hand is passed directly to the anterior plane of the fœtus and then to the part where the feet and knees are; by the other plan the hand follows the lateral plane of the fœtus until the lower limb is found, and then a finger may be hooked behind the knee, and the latter thus drawn to the mouth of the womb when the leg is extended and the foot brought into the vagina.

The objections made by Hergott to the German plan, which he admits is the more rapid, is that upon the anterior plane the four members, hands and feet, forearms and legs, arms and thigh, are situated very near each other, and sometimes crossed, so that difficulties of distinction may be presented, and the accoucheur is liable to bring down a hand instead of a foot. He also states, however, that one is often compelled to do as he can, neglecting the rules which seem the best and safest.

In regard to the selection of the foot of the fœtus—usually only one will be brought down—and means of securing it, the reader is referred to pp. 328–330.

When the foot is brought into the vagina a noose of thick muslin may be placed around the ankle so as to have a secure hold by which traction can be exerted, and this traction be outside of the vagina, the latter being a point of essential importance when, as in some cases of transverse presentation, the head cannot be dislodged, either by external pressure or by pulling upon the foot, and the hand must be introduced into the vagina to push it up. It must be remembered that the movement given to the pelvic end of the fœtal ovoid by pulling upon one or both feet is to be assisted by a corresponding movement impressed upon the cephalic end by the hand pressing on it through the abdominal wall.

If podalic version be required in shoulder presentation, when the arm has prolapsed, it is not always necessary to begin by returning the arm, but a noose is placed upon the wrist so that it may be drawn down when the chest is delivered, preventing its ascension by the side of the head; of course, when the prolapsed arm interferes with the introduction of the operator's hand, the former should be pushed up in the anterior portion of the vagina. Turning having been accomplished the delivery of the child is, in most cases, left to uterine action, as in an original pelvic presentation. But if traction upon the limb or limbs be necessary, because of inefficiency of uterine action or the necessity of speedy delivery, it must be made simultaneously with the contraction of the uterus, and assisted by manual pressure upon the abdomen. The rules as to the delivery of the trunk and head, the care of the cord, and the treatment of ascension of the arm or arms are found on pp. 321–324.

CHAPTER XI.

THE FORCEPS.

THE *forceps obstetricius*, known because of its great value as simply the forceps—asserted by Baudelocque the most useful of all surgical instruments—made possible the rule given by Hippocrates, that in certain difficult labors the hands should be applied to the child's head, and extraction made. The forceps furnishes artificial hands to be applied to the child's head, and delivery accomplished without injury to it, thus making possible that which the unarmed, unaided human hands could not do. Yet, how many centuries the obstetrician waited for the ideal of Hippocrates to be made real, and how powerless obstetric art in certain emergencies until this was accomplished!

The word *forceps*, plural *forcipes*, is not derived, as some authorities have stated, from *fortiter* and *capiens*, or *capio*, that is, seizing strongly, but from *formus*, warm, and *capio*, as the use of the word by Virgil and Ovid in describing the work of the Cyclops plainly proves, and as also shown by the employment by other writers of the word *formucales*, which Scaliger has said should be *formucapes*, as a synonym for *forcipes*.[1] Whatever the derivation, all understand by the forceps an instrument which with safety can be applied to the head of the child, and its delivery effected, assisting the forces of Nature when they are insufficient, or replacing them if absent.

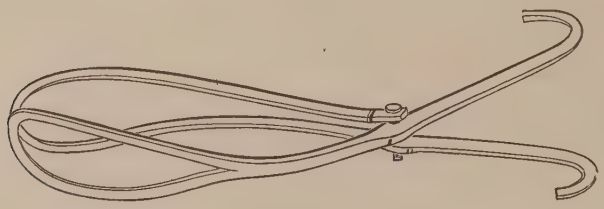
History of the Invention of the Forceps. In the year 1569 William Chamberlen, who, it is believed, was a medical practitioner, and his wife with their family had been living in Paris, but they were compelled, because of being Huguenots, to remove, and they took refuge in England. Peter Chamberlen, a son, was then about ten years old, and growing up to manhood, became a medical practitioner; he was the inventor of the forceps, as established by the careful researches[2] of Dr. Aveling. The date of the invention is not known, but it probably was some time in the last of the sixteenth or the first of the seventeenth century. On the next page a representation of the forceps first invented is given. The branches cross, and this is the case with almost all forceps made since. They are fastened by a screw. The Chamberlens had at least three other forceps similarly made, but somewhat improved upon this model.

The invention was carefully concealed by the family, at least three generations of which were represented in the medical profession. In 1670 Hugh Chamberlen, a descendant of the brother of the inventor, went to Paris, hoping to sell the forceps for "10,000 *écus*," about six thousand dollars. After spending some six months, his negotiations came to an abrupt close by his failing to deliver a woman who had such pelvic deformity that Mauriceau, then in the height of his fame as an obstetrician, declared could only be delivered by the Cæsarean operation. The latter, who we may be sure would tell the worst in regard to the conduct of this would-be rival, states that Chamberlen asserted he could deliver the poor woman in half of a quarter of an hour, but that he tried for three hours without stopping except to take breath, uselessly exhausting his

[1] Dictionnaire encyclopédique des Sciences médicales. Chereau's article upon the forceps.
[2] The Chamberlens and the Midwifery Forceps.

strength as well as his industry, and then abandoned his efforts when he saw that the patient was likely to die on his hands. The post-mortem examination of the woman, who lived twenty-four hours after Chamberlen's attempt, showed that the uterus had been greatly injured by the instrument.

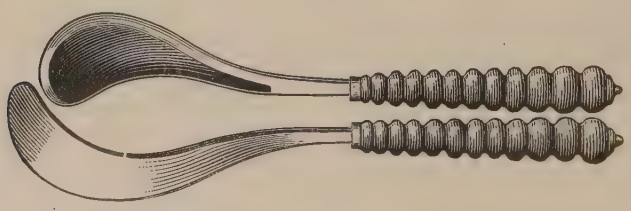
FIG. 228.



CHAMBERLEN'S FORCEPS.

In a few days Chamberlen returned to England. In 1693 he went to Amsterdam, and was more successful in his efforts to dispose of his secret than he had been in Paris, for the famous Roonhuysen became its purchaser. The latter associated with him Ruysch and Boelkman, and the firm, with their successors, seem to have carried on for several years a successful trade in the forceps; this traffic was greatly increased by the original purchasers having a law passed forbidding any to practise obstetrics unless first examined by them, and then purchasing the secret. The baseness of those who thus trafficked in the forceps sank, as Kleinwächter says, still lower; for in some cases only part of the secret was sold, one blade of the forceps being given. Roonhuysen had a student named Van der Swam, who had been with him several years, and whom he had promised to teach the art of delivery, but had failed to make his promise good. One day this student had, by a fortunate accident, an opportunity to see the forceps without the knowledge of his preceptor. He made drawings of it, and let a friend have them; that friend communicated them to Peter Rathlaw, who coming to Amsterdam to practise obstetrics, had been rejected by the Amsterdam examiners because he refused to buy the secret. Rathlaw made good use of the knowledge acquired after his rejection, for, actuated possibly by revenge, he published a description of the forceps in 1747.

FIG. 229.



PALFYN'S FORCEPS.

In 1716 Jean Palfyn, of Gand, who was a celebrated surgeon, presented to the Paris Academy an instrument devised by him, consisting of two parallel blades, which were to be applied, one on each side, to the fœtal head, and by which extraction was to be then made; they were known as the Palfynian hands, *Manus Palfyniana*. Different devices were used for fastening the hands together after their introduction—Heister, among others, attempted thus to make the instrument useful, but failed—the instrument was not successful. Still it represented an idea in the construction of the obstetric forceps which a hundred years after was made practical, and which an obstetrician of the present day, Chassaignay, has sought to realize, regarding it as of great importance that the branches of the instrument should be parallel instead of crossing.

The celebrated obstetrician La Motte had Palfyn's instrument described to him by a friend at Paris, and he declared that it was as impossible to use it successfully as it would be to pass a cable through the eye of a needle.

In 1734 Mr. Alexander Butter, surgeon in Edinburgh, published an account "of a forceps used by Mr. Dusé, who practised midwifery in Paris," stating that it was "scarce known in this country, though Mr. Chapman tells us it was long made use of by Dr. Chamberlen, who kept the form of it a secret, as Mr. Chapman also does." Nevertheless, "Chapman, in 1733, published a description and plate of the instrument, which he had used from the year 1726, stating it to be the instrument used by the Chamberlens, but without stating whence he had procured it." (Churchill.) It also appears that Drinkwater, of Brentford, "surgeon and man-midwife," who began practice in 1668, and died in 1728, had similar forceps. From the time of the publication by Chapman the Chamberlen forceps became the property of the profession.

The conduct of the Chamberlens in keeping the forceps a family secret has met with general professional condemnation. Recently, however, some voices have been lifted up, if not in defence, at least in palliation of their conduct, Aveling, for example, saying that it is not fair to judge members of the profession who lived two hundred years ago by the code of ethics which medical men now accept; and Poullet promptly adds that those who condemn the Chamberlens commit an anachronism.

Right must have some firmer foundation than the shifting sands of public opinion; "ought is an ethical atom," not merely in the fact that it is an ultimate defying analysis, but that it remains always the same; human standards of right and wrong may vary with knowledge, with conventionalities, and the prevailing sentiment of the times; nevertheless, none nor all of these can make that right which is essentially wrong. The ethical rule which governed the conduct of the Chamberlens was not found in the teaching of Hippocrates, and no one for a moment can suppose that if Sydenham or Harvey had invented the forceps, and learned its great value for the saving of human life and the relief of human suffering, either would have kept it secret, but rather would have hastened to proclaim the instrument and its importance to the profession. The general verdict of the profession upon the conduct of the Chamberlens had better remain undisturbed.

Varieties of Forceps. Kleinwächter states that at the beginning of the present century every professor thought it important he should devise a new forceps, which, of course, when made, received his name. This ambition has not been limited to obstetric teachers, nor is it yet extinct. The profession has thus had forceps almost innumerable —some long, some short, some with narrow blades for introduction in the only partially dilated os; others with asymmetrical blades for sacropubic application; some of "gigantic volume," dangerous alike to the mother and the fœtus; a few physicians have invented what Delore has called microscopic, or pocket forceps—mere toys, or at least capable of meeting only the most trivial needs.

Undoubtedly hundreds of obstetric forceps have been devised, but, in regard to each one of the majority of these hundreds, only a single instrument has been made, and that for the inventor. In some instances the new forceps which gave fame to the inventor never existed, probably, save in the form of a drawing,[1] nevertheless, drawing and description have been published of the author's instrument.

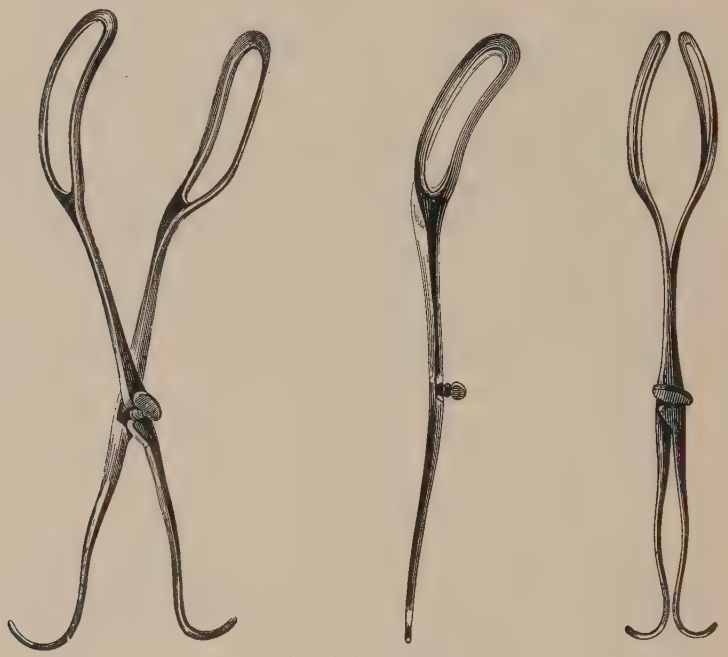
Velpeau wisely remarked that very many of the alleged improvements in the forceps have been made by young men who have not yet

[1] The writer happens to know of a treatise on obstetrics in which the author gives a representation of his forceps, and yet the instrument never advanced beyond this primary condition; it exists only as a drawing.

learned that in all surgical operations much less depends upon the form of the instrument than upon the skill and ability of the man.

The most important improvement in the Chamberlen instrument was that made by Levret, the addition of the pelvic curve; he presented his "new curved forceps" to the Royal Academy of Surgery, Paris, in January, 1747. It was not until after 1751 that the great British obstetrician, Smellie, speaks of using the pelvic curve in his instrument. Pugh, a contemporary of Smellie, a practitioner at Chelmsford, England, published in 1754 the statement that he had invented the pelvic curve in 1740. But professional opinion cheerfully concedes priority in the invention to Levret, because of priority of publication.

FIG. 230.



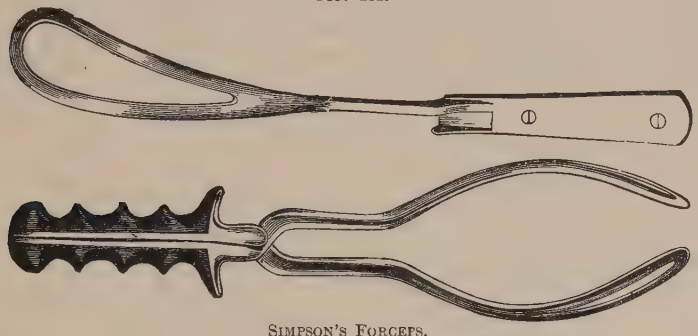
HODGE'S FORCEPS.

Obstetricians universally accept the advantages of the pelvic curve. Not so, however, with the next great improvement in the instrument, that of Tarnier (1877), by which traction is made in the axis of the birth-canal, some regarding the axis-traction forceps—chief among them is Pajot—as no advance upon the old instrument. A few obstetricians, especially those of Lyons, have insisted upon the importance of the branches being, as in the forceps of Palfyn, parallel, instead of crossed.

DESCRIPTION OF THE FORCEPS. The short, straight forceps, which never was much used in this country, and which has fewer advocates abroad, in Great Britain or Ireland, than it had even twenty years ago, will not be considered in this description, the ordinary long forceps only being referred to. This consists of two halves, known as branches or

arms, these branches being distinguished as right and left. A fundamental law governing their application gives rise to these names; thus the left branch is held in the obstetrician's left hand, and introduced in the left side of the mother's pelvis, while the right branch is held in the right hand, and introduced in the right side of the pelvis—and this is the only unchangeable law in the application of the forceps. The instrument is made of steel, and the blade should have some elasticity, but not the least flexibility; the surface should be smooth and polished, so as to be readily and thoroughly cleaned; the gutta-percha covered instruments ought to be rejected, for, in spite of all care, the covering will be broken, and the roughened surface thus left will be a most inviting lurking-place for septic poison. Each branch is divided into a handle, an articulating portion or joint, and a blade. The handle must be shorter than the blade, lest too much power of compression be

FIG. 231.



SIMPSON'S FORCEPS.

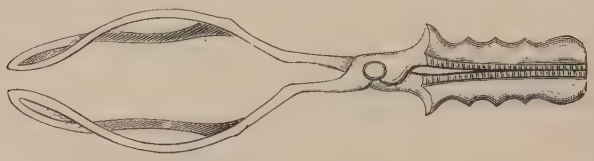
given the instrument. In many forceps the handle ends externally in a blunt hook, which, in rare emergencies, may be of value, but often proves an inconvenience, and can very well be omitted. The handles should be covered upon their external side with ivory or ebony, this being grooved or notched, so that they may be firmly grasped. In some instruments, Simpson's for example, each handle has near the lock a transverse projection, or shoulder, so that two fingers can be placed over these when traction is made; a similar addition can be usefully made to the Davis forceps, and thus not only a convenient method for traction is secured, but avoidance of too great compression of the head, which might occur, at least with some forceps, when the handles are firmly grasped. In Bedford's forceps rings take the place of shoulders in Simpson's. The lock may be a fixed button or tenon upon one branch, which accurately fits into a mortise or depression in the other; or there may be a screw which, after locking, can by a few turns be made to fasten the branches more firmly together; or that which is known as the English lock, as seen in the illustration of Simpson's instrument, the one branch notched just beyond the shoulder, and into this notch a narrowed part of the other fits.

The blade is fenestrated,[1] thus making it lighter and securing better

[1] An exception to this rule is given by Hecker's forceps—the blades having no fenestra.

adaptation to the fœtal head; the fenestra has somewhat the form of an elongated oval, and both the external and internal margins of the blade are bevelled. Looking at the branches when locked, it will be seen that each blade presents above a concavity, below a convexity; this curve was called by Levret the new curve, but is generally known as the pelvic curve; it adds greatly to the facility of applying the instrument when the head is in the pelvic cavity, or at the inlet, and to its efficiency. Another curve which all forceps have in common with that originally invented, is called the cephalic curve; each blade is concave internally, but convex externally; the blades thus fit closely upon the fœtal head, and at the same time occupy the least space. In no forceps is this curve better adapted to the sides of the fœtal head than in the Davis instrument. When the branches of the forceps are united the points of the blades should not touch, but be at least half an inch apart; the distance between the blades themselves varies in different instruments; thus, it is three inches in Simpson's, two inches and a half in Hodge's, and two and a fourth in Davis's. It should be remembered that this measurement is made between the two opposite most distant points of the margins of the blades.

FIG. 232.



THE DAVIS FORCEPS WITH SHOULDERS ON HANDLES.

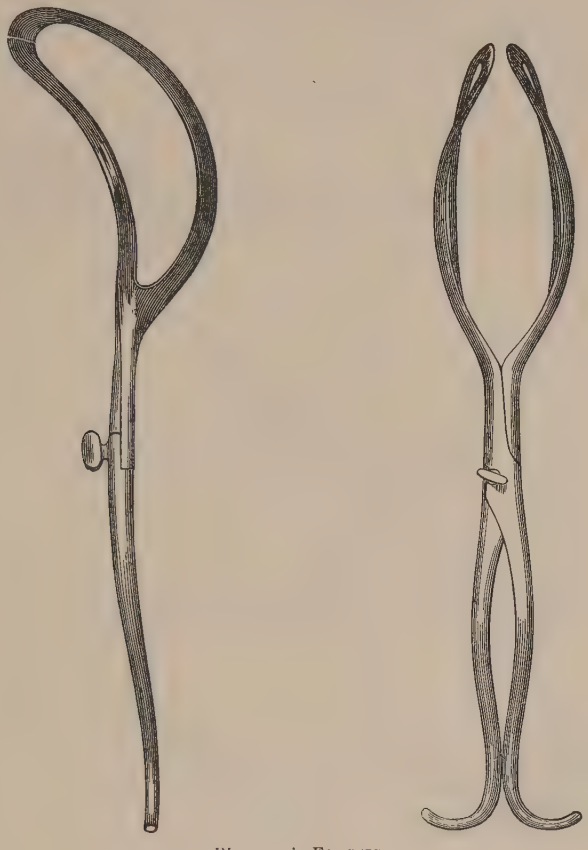
Forceps vary in length, and even the same forceps varies as furnished by different makers. In illustration of the latter point, I have three of the so-called Davis forceps, procured from three different dealers; one of the instruments is less than eleven inches in length, while the second is thirteen, and the third is fourteen inches long; the first instrument, though procured from a leading New York house, is coarse, heavy, and does great injustice to one of the best of obstetric forceps, while the second is modelled in all essentials after the forceps used by the late Professor Meigs, weighs but ten ounces and a half, and is adequate to almost every case in which forceps delivery is advisable. The Hodge forceps is sixteen inches long, that of the late Dr. Wallace, fifteen inches; Braun's Simpson, fourteen inches; Elliot's, fifteen inches; Robertson's, thirteen inches and a half; Barnes's, fifteen inches; Pajot's forceps is forty-five centimetres, and Stoltz's forty-two, the same length as Levret's.

The forceps represented (Fig. 234) is that of Dr. Joseph Holt, of New Orleans, formerly Professor of Obstetrics in the New Orleans School of Medicine. This instrument is, I believe, used by many Southern practitioners. Its inventor presents the following claims in its behalf:

"A minimum weight of metal compatible with full efficiency. Such a distribution of the metal as shall insure resistance and compressing power where these are especially required, elasticity where required, and all in proportion. The pelvic curvature is in actual correspondence with the curve of Carus, whereby the instrument can be applied at the superior strait, or even above the brim, as easily as at the pelvic floor. On account of this curvature, the head at the brim can be pushed downward and backward in the direct axis of the superior strait as surely as it may be drawn down with a Tarnier forceps, and that, too, with all the power of which a man is capable, certainly enough for the safety of maternal and fœtal tissues. It can accomplish the work of the latter

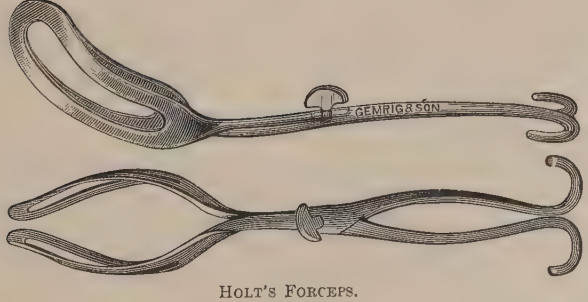
instrument without any of its complex machinery. Again, this curvature insures the points at no time pressing upon the sacrum. The bowels accurately

FIG. 233



WALLACE'S FORCEPS.

FIG. 234.



HOLT'S FORCEPS.

adjust themselves to the child's head, securing uniform and general distribution of elastic pressure. The points, nearly parallel and flat, enable the blades to be

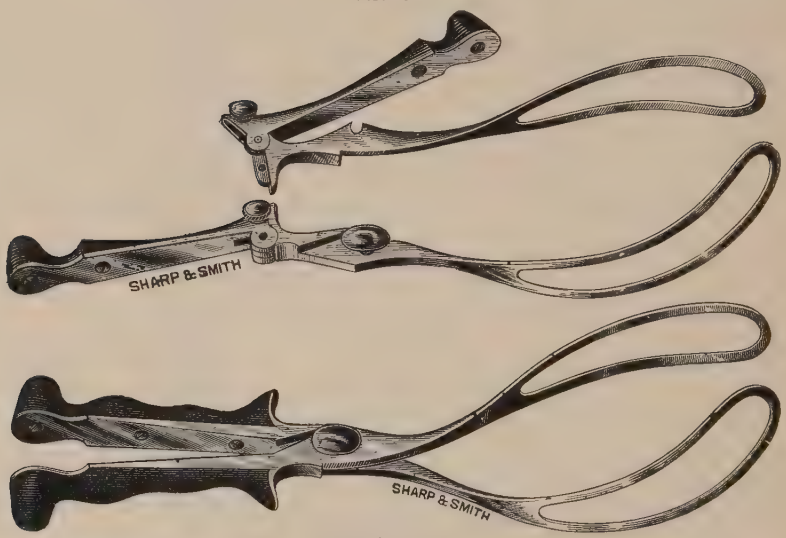
passed, insinuating themselves between impacted surfaces. There is no degree of impaction that will not permit the instrument to be applied without force, as abundantly proved in practice. Being on, the points compress gently, but never injure; this peculiar modification in the points was introduced many years ago by Dr. Warrington, of Philadelphia."

Fig. 235 is a representation of the forceps invented by Prof. T. A. Reamy, of the Medical College of Ohio.

FIG. 235.

REAMY'S FORCEPS.

FIG. 236.



MILLER'S FORCEPS.

Fig. 236 represents the forceps of Dr. DeLaskie Miller, formerly Professor of Obstetrics in Rush Medical College. This forceps is 14¾ inches long, the width between the points of the blades ¾ of an inch, the blades are 6¾ inches long and 3 inches apart; the handles are folding, and thus the instrument made more portable.

POWERS OF THE FORCEPS. 1. A dynamic action has been claimed for this instrument. It sometimes happens that even after the introduction of a single blade of the instrument languishing uterine contractions are quickened, or absent ones recalled, and so much importance was attached to this occasional occurrence that Kilian devised a galvanic forceps, hoping thus to increase the dynamic power of the instrument, but the experiment, of course, failed. The obstetrician, so far from seeing any quickening effect upon uterine and abdominal force resulting from the application of the forceps, may find this activity entirely

ceasing, and hence no trust can be put in a dynamic action of the instrument.

2. The forceps may be used to compress the fœtal head. Experiments have proved that the diameter compressed can be reduced to a little more than one-third of an inch, and that compression carried beyond this is liable to cause fractures. Moreover, when the blades are applied, as they ought always to be, if possible, to the sides of the child's head, there is no gain in compressing any of the transverse diameters, as there is no hindrance arising from any of these being too great. Still more, if the biparietal diameter be lessened by compression, the sub-occipito-bregmatic is increased,[1] so that there is no absolute, or only slight, diminution of the head-circumference. Further, such compression hinders the moulding of the head, by which nature seeks to adapt it to the canal it must pass through; it hinders, too, the movements of the head occurring in normal labor. That a particular forceps is a powerful compressor is not a commendation, but a condemnation. In traction more or less pressure is made upon the head; according to Delore's experiments, the pressure perpendicularly to the axis of the head is about one-half the traction, and hence there is a relation between the force of traction and the degree of compression. Most obstetricians regard any compression beyond that which is required to prevent the instrument from slipping unnecessary, and it may be injurious.

3. The forceps as a lever. Notwithstanding arguments by some, especially by Dr. Mathews Duncan and by the late Dr. Albert H. Smith, against the pendulum, lateral, or oscillatory movements of the forceps, most obstetricians use them in certain conditions, and this practice is indorsed by Delore and Berne. The former states, as the result of his experiments made with the dynamometer, that by slight oscillatory movements great differences are obtained, which may vary from twenty-five to sixty-five kilogrammes, when strong tractions are used. In using the forceps as a lever, the fulcrum is on one and then on the other side of the birth-canal—or one of the hands of the operator may be placed externally upon one, then upon the other side of the vulval margin, and thus be made the fulcrum, while the other grasps the handles—the power is at the handles, and the resistance the head, firmly held by the blades. As Spiegelberg especially enjoins, traction should always be associated with this to-and-fro movement, a movement which should be gradual, not abrupt, and not great, and should only be regarded as a supplement to the former when that is insufficient to effect delivery; if traction be not made, the head simply see-saws with the lateral movements, the fulcrum on each side not advancing, but constantly remaining the same, and thus no progress is made in delivery.

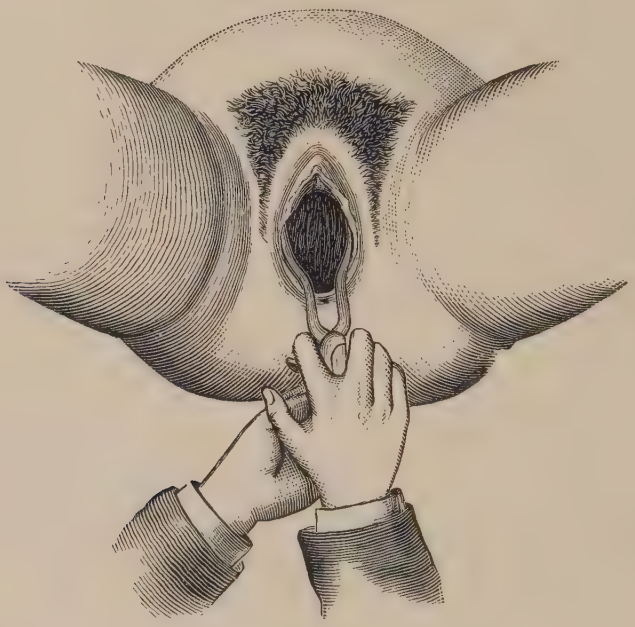
4. The forceps used to effect rotation. It not unseldom happens that in occipito-anterior positions the introduction of the posterior blade of the forceps causes the occiput to rotate in the pubic arch. In persistent occipito-posterior positions many obstetricians advocate at least the attempt to produce anterior rotation by the forceps.

While in the pendulum movements the fulcrum passes down in a

[1] Recent investigations, which will be mentioned, seem to invalidate this statement; but they need fuller and direct confirmation before their general acceptance.

straight line, in the rotation movements it moves spirally. Spiegelberg further states that a ring so tight upon the finger that it cannot be removed by pulling in a straight line, but can be by twisting movements, or partial rotations, is an imperfect illustration of the pendulum and rotation movements. He regards rotation movements as less efficient, and decidedly more dangerous than pendulum movements, but says that they may be useful when the position of the head is not known, as indicating the right direction for traction, and that of least resistance. This doctrine should be accepted not without hesitation, and yet, coming from such eminent authority, not be rejected without just consideration. But in general the use of the forceps as a rotator is only exceptionally advisable, and frequently then the attempt is only an attempt—simply an experiment.[1]

FIG. 237.



TRACTION WITH THE COMMON FORCEPS.

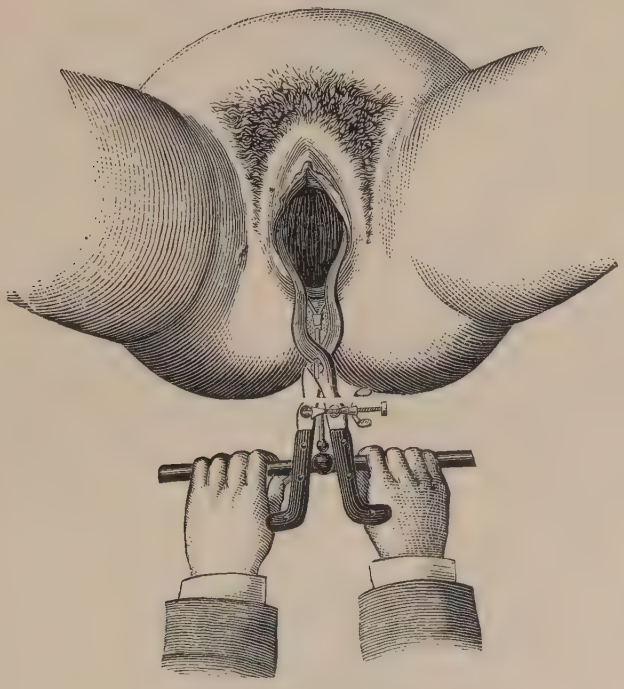
5. The forceps as a tractor. Having thus considered the doubtful or occasional powers of the forceps, or powers that are only exceptionally required, we come finally to the essential power of the instrument, that of traction. The pulling power made by means of the forceps is to be considered in reference to the force exerted, the line of direction of the pull, and as to whether this traction should be intermittent or continuous.

In easy labors the force exerted is probably, as stated by Mathews Duncan, little more than equivalent to the weight of the child; in

[1] Rotation of the head by the forceps, conjoined with manual rotation of the body. Ostermann's method, will be described hereafter.

difficult labors it is very much greater, possibly amounting to fifty pounds, and in forceps delivery it is in some cases very much greater than even the latter. Delore makes the following statement as to the force that can be used with the forceps: A man without support, that is, not bracing himself, exerts a force equal to 88 pounds; with support, twice as much, or 176 pounds, the same as two men, but the two with support, 286 pounds. Tarnier states, and the statement is indorsed by Delore, that it is scarcely ever necessary to use a force exceeding 132 pounds; more than this is dangerous. According to Spiegelberg, the pulling should be done with the forearms, while the arms rest by the sides; there is usually no necessity for extending the arms, still less for bracing the body by placing the feet against the bed.

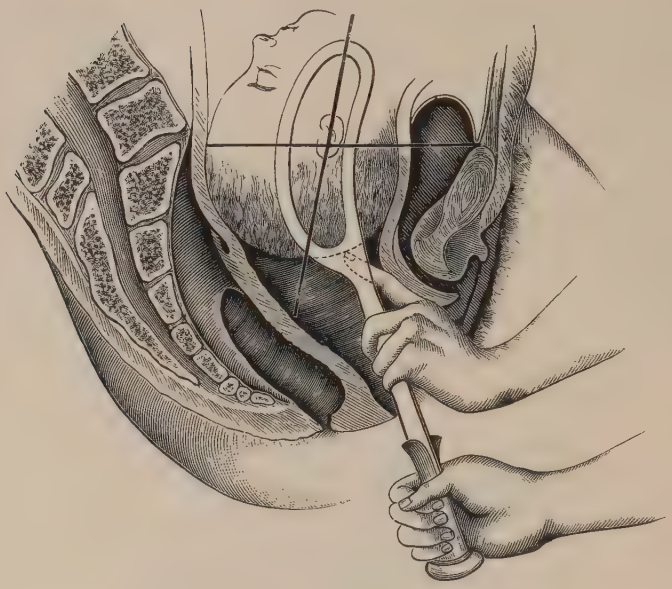
FIG. 238.



TRACTION WITH TARNIER'S FORCEPS.

It is universally agreed that the direction of the pull should correspond with the axis of the birth-canal. But what is that axis? Obstetricians for a time held that it was represented by the curve of Carus, and then a parabolic curve was substituted, as better showing this axis; but as the investigations, first of Fabbri, afterward of Sabatier, of Pinard, and more recently of Boissard, and of Varnier, show, the obstetric pelvis—the dynamic as distinguished from the static pelvis—the soft parts being appended to the bony pelvis, and those which make the pelvic floor, thus forming the entire pelvis—presents a cavity which is not in any respect a curved canal, but approximates the

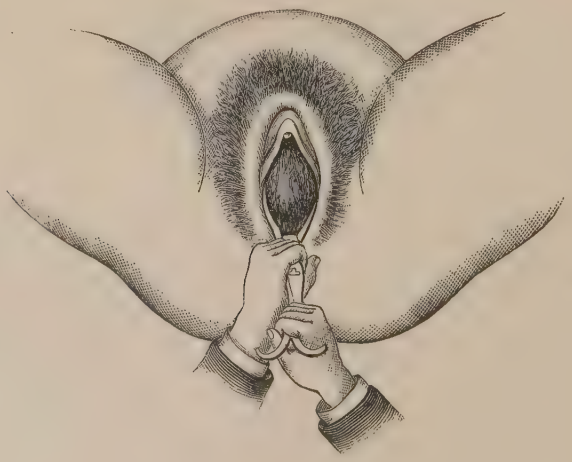
Fig. 239



Smith's Method of Making Axis-traction.

form of a cylinder, having two walls, anterior and posterior, almost vertical, and at the fundus forming a plane nearly perpendicular to these two walls. This cylinder has its fundus at the coccyx, and an opening upon the anterior wall. Now, laying aside confusing curves, pelvic inclined planes, and speculative synclitisms, the head descends to the pelvic floor in a straight line, then turns at almost a right-angle to make its exit at the vulva ; in other words, the axis of the birth-canal

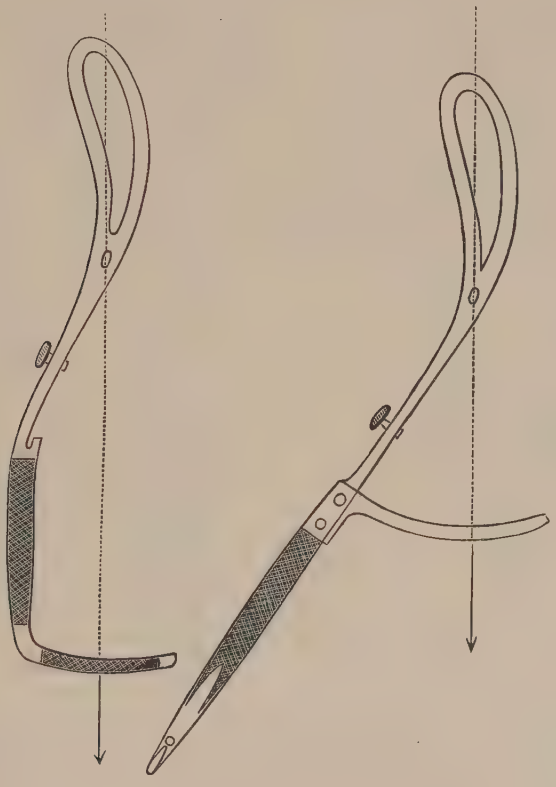
Fig. 240.



Pajot's Manœuvre.

is at first a line directed backward and downward, and then a line almost perpendicular to it. Hence, until the head reaches the pelvic floor, the fundus of the pelvic cylinder, the traction with the forceps must be downward and backward, and then upward and forward.[1] When the head is high in the pelvic cavity, or is just entering the inlet, pulling downward and backward, that is, in the axis of the obstetric pelvis, is not an easy task ; and yet, if it be not done, there is a great loss of power.

FIG. 241.



TWO FORMS OF HUBERT'S FORCEPS WITH TRACTION-ARM AT RIGHT-ANGLE TO HANDLE.

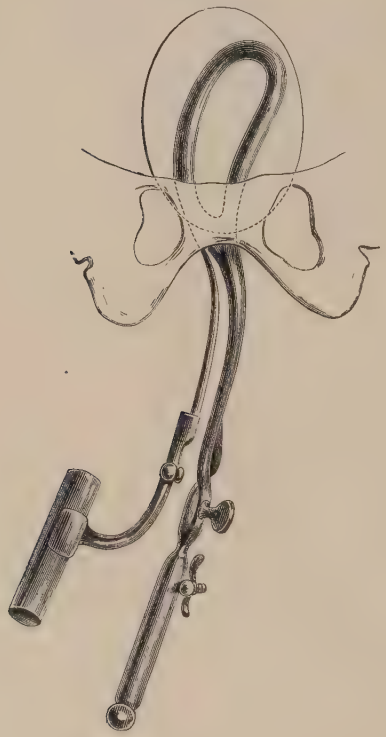
Now, to effect such traction, many obstetricians, since Osiander, have resorted to pressure downward at or beyond the forceps lock with one hand, while the other grasps the handles near their end, not so much for making traction as to resist the downward pressure of the other hand, and thus the handles become a lever rather than a means by which pulling is directly done.

Pajot's method is the following : " We apply the left hand as near

[1] The reader is referred to page 45 for the views of Farabeuf and Varnier as to the lines of traction in the use of the forceps.

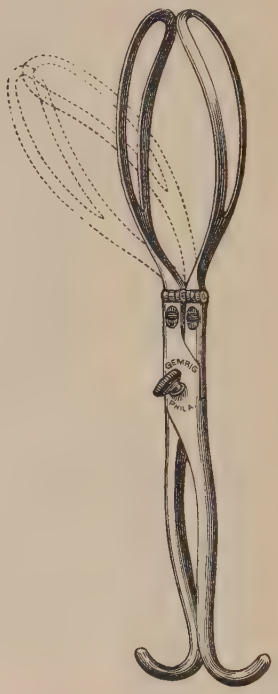
as possible to the vulva, the right hand near the end of the handles; then we use sometimes these two hands in order to make the forceps, at times a lever of the first order, sometimes of the third, sometimes a lever and a tractor at the same time, sometimes a direct tractor, according to the resistance and the height of the pelvis at which they are found."

FIG. 242.



TARNIER'S AXIS-TRACTION FORCEPS.

FIG. 243.



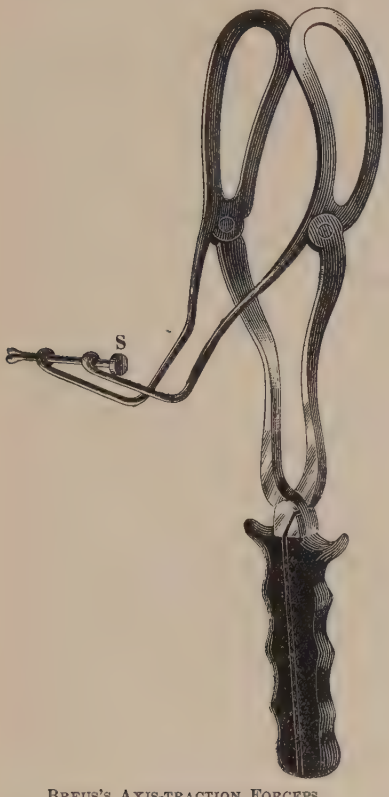
MCFERRAN'S FORCEPS.

Other methods of securing axis-traction have been by certain changes of the forceps itself or by attaching to it, at or near the blades, traction-rods. Hubert (1860) had arms projecting from the under surface of each handle of his forceps. Morales gave the handles of his instrument a perineal curve, so that in pulling on the lower portion the pull was, theoretically at least, in the axis of the pelvis. Hermann, in 1840, applied traction-rods to the forceps blades, but this invention seemed to cause no attention until after 1877, the year in which Tarnier first exhibited his own forceps with a similar device. Fig. 242 is an illustration of Tarnier's instrument, not as originally devised, but as subsequently modified.

Several modifications of Tarnier's instrument have been made; Simpson's and Lusk's, for example, are excellent; other axis-traction forceps have been devised, and among those worthy of note are the instrument of McFerran, of Philadelphia, and that of Breus. Though many

distinguished obstetricians have hailed the forceps of Tarnier as marking a new era in obstetrics, and as being the only important change since Levret gave the forceps the pelvic curve, others, chief among whom may be mentioned Pajot, prefer the old instrument, "the classic forceps." Tarnier's is a much more expensive instrument and more

FIG. 244.



BREUS'S AXIS-TRACTION FORCEPS.

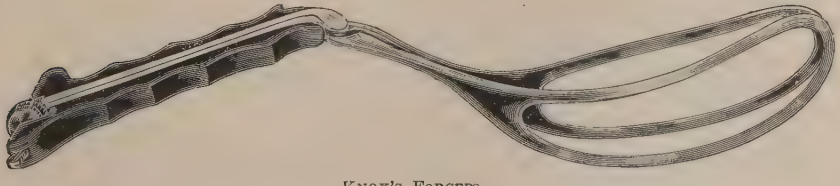
FIG. 245.

STEPHENSON'S DEVICE FOR AXIS-TRACTION.

complicated, and probably never will supersede the old forceps, while it presents great advantages in special cases, which, however, rarely occur to the general practitioner.

Winckel regards Breus's forceps as preferable to all others because of lightness of the instrument and the facility of its application.

FIG. 246.



KNOX'S FORCEPS.

Fig. 245 represents the forceps of Dr. Stephenson, Professor of Midwifery in the University of Aberdeen. It will be observed that axis-traction is sought by means of a rod hooked in front of the lock. This instrument was shown at the Glasgow meeting of the British Medical Association in 1888.

Fig. 246 represents the axis-traction forceps of the late Dr. J. S. Knox, of Chicago.

Poullet, of Lyons, has an excellent forceps to the blades of which he attaches tapes, and these in turn are fastened to a handle for pulling, thus seeking to accomplish axis-traction. No one who tries this device and compares the facility of employment, and efficiency of the instrument, after having used Tarnier's forceps, or any one of its excellent modifications, will for a moment give preference to Poullet's forceps or any of its imitations.

The general rule, as to traction with the forceps, is that it should be intermittent—a pull and a pause—our art thus an imitation of nature, which in normal labor expels the child by intermittent, not by continuous contractions. Nevertheless, Pinard regards slowness of traction as more important than intermittence.

Indications for the Use of the Forceps. The forceps is alike the mother's and the child's instrument, and the indications for its use may be summed up as, whenever the life of either requires immediate delivery. Thus, on the part of the mother, convulsions, hemorrhage, rupture of the uterus, excessive feebleness, threatened asphyxia from cardiac or pulmonary disease, arrest of the progress of the labor from perineal resistance; on the part of the fœtus, prolapse of the cord, complicated presentation, sudden death of the mother, feebleness of the cardiac pulsations, either associated with great slowness or frequency, showing interference with the utero-placental circulation, or compression of the cord may be present, and demand instrumental delivery. May the obstetrician use the forceps solely for the purpose of shortening the mother's suffering? Spiegelberg admits this indication, and wisely adds that he who undertakes such "*luxus-operation*" must understand how to control his hands intellectually and mechanically; but this is not always the case, and the intended assistance is often the reverse.

That the forceps is too frequently used cannot be doubted, and that in consequence of its unnecessary employment many times the perineum has been torn, or other injury been done the mother. It probably will not be required in more than 5 or 6 per cent. of cases of labor. This position may be strengthened by quoting the statistics given by Winckel and those of Ahlfeld. The former, in 100,000 deliveries at various clinics in Europe, found that the forceps was used in 4.6 per cent. of all; the latter states that in 2900 births in the Marburg Maternity, the forceps was employed only 81 times—that is, in 2 8 per cent. In the clinic of Professor v. Rosthorn, Prague, there were, from 1891 to 1894 inclusive, 2920 women delivered, and the forceps used in 3.63 per cent.

Conditions Necessary for the Use of the Forceps. 1. The forceps is to be applied to the head of the child; the head may be first or last, the presentation may be cranial or facial, but the rule is to apply the forceps blades only to the head.

The application of the forceps in pelvic presentation was probably first suggested by Levret, and in recent years Pajot has given this use of the instrument a qualified approval if the child be dead. But for several years some obstetri-

cians have used the forceps in pelvic presentations when the child was living, and sometimes delivery has thus been safely accomplished, after the means usually resorted to in delayed pelvic deliveries had been vainly tried.

While probably other modes of artificial delivery in pelvic presentation will be usually selected, yet the operator, if expert with the forceps, need not hesitate to use it, after the experience of Tarnier, Lusk, and others; the best instrument, except, of course, one of those devised for the purpose, is Tarnier's, because of its unvarying compression. Nevertheless, the few trials which I have made of this application of the forceps have been unsatisfactory.

2. The mouth of the womb must be completely dilated, or so far dilated and so dilatable that the blades can be readily introduced and applied, and then extraction of the head made without injury to the lower segment of the uterus; if this rule be neglected, there is danger of the forceps blades tearing the neck of the womb as they are introduced, or else, when traction is made, the lower uterine segment will be dragged down, or the tissues about the mouth of the womb be lacerated or seriously bruised.

Dubois devised forceps with narrow blades for introduction into the partially dilated os, but, according to Tarnier, the results were bad. The late Dr. Taylor, of New York, also had narrow-bladed forceps for similar use.

3. The head must be of normal size and consistence. A small or macerated head readily slips out of the forceps blades, and these cannot be sufficiently approximated if the head be very large, as, for example, in hydrocephalus.

FIG. 247.

FORCEPS OF ASSALINI.

The advocates of forceps with parallel instead of crossed branches claim as an advantage of such instrument that it is peculiarly adapted to large heads, grasping these with such firmness, and yet without injury, that extraction can be more readily accomplished. We present one form of the forceps with parallel blades.

4. The birth-canal must present no serious hindrance, either from pelvic deformity or from neoplasms, to the passage of the child. The hindrance most frequently arises from narrowing of the pelvic inlet, and the question as to whether podalic version or the application of the forceps be indicated, is one in regard to which eminent obstetric authorities differ. Barnes makes the limit in the pelvic narrowing as three inches and a fourth, which will admit of the useful application of the forceps, at the same time stating that a head slightly below the normal size, and less firmly ossified than usual, may be brought through a conjugate diameter of only three inches. Pinard holds that if the pelvis measure less than eight centimetres, the infant being at term and presenting normal ossification of the bones of the head, the forceps is

not to be applied but with the greatest prudence; traction should be made gently and slowly, for the cases of exceptional success reported by different authors have naturally caused excessive tractions which could not but mutilate the fœtus, and, further, kill both mother and child.

5. Spiegelberg made the condition positive that the head has passed the inlet by its greatest periphery, while Pajot regards it as favorable for the application of the forceps. When obstetricians speak of the head being at the superior strait or inlet, they do not mean that it is just at its entrance, but that it has so far descended the parietal protuberances are as low as the ilio-pectineal line. The application of the forceps when the head is movable above the inlet is rejected by most obstetric authorities, podalic version being preferred, unless, as stated by Charpentier, the uterus, in consequence of the flow of the amnial liquor, is strongly contracted upon the fœtus, rendering version impossible, and one then may use the forceps. Those who are partial to Tarnier's axis-traction forceps regard it as peculiarly favorable for use when the head is high up, not having entered the pelvic inlet. Spiegelberg observed that such application when the head is high, or, perhaps, to the movable head, is not a matter of indifference for mother or for child, and must not be made to the extent that many claim. Hodge regarded "fixation of the head and its partial projection through the superior strait" as "essential prerequisites for the operation of the forceps."

Preparations for Using the Forceps. There are but few women suffering the agony of childbirth who will not gladly accept means which will shorten the duration of that agony; but few, when their unborn child is in peril, who have not the maternal instinct so strong that they will cheerfully consent to the use of the forceps to avert that peril. It is unnecessary, as some obstetric authorities have recommended, to show the patient the instrument; if foolish and timorous, she will not be thereby reassured, but rather have her fear increased; while the wise and courageous are willing to trust their physician. Delore very well suggests that, if it happen the obstetrician has not his forceps with him, it is better to send rather than to go for the instrument, lest the labor end in his absence.

If the fœtal head be low, and only the resistance of the vulvo-vaginal outlet to be overcome, the patient may be brought to the foot of the bed, the lower limbs being flexed; but if the head be in the pelvic cavity, or at the inlet, she should be placed across the bed, her hips at its edge, and each foot resting on a chair, while each knee is held by an assistant. The bladder is evacuated by a catheter, if necessary, for the use of the forceps when this organ is full may cause most deplorable injury to the vesico-vaginal wall. The use of an anæsthetic is advisable in most cases; however, this may usually be left to the decision of the patient, it being always remembered that the anæsthesia is obstetric, not surgical. The vagina is washed out with an antiseptic solution. The obstetrician has at hand hot water and other means that may be necessary if the child happen to be partially asphyxiated,[1] and also his hypoder-

[1] Dr. T. G. Davis, of Bridgeton, N. J., has informed me of his success with the recent method of rhythmic traction of the tongue in asphyxia of the newborn. "I seized the tongue between the

matic syringe, sulphuric ether, and a liquid preparation of ergot, in case the condition of the mother after delivery should require either of the latter two to be given. He auscultates the fœtal heart, and thus knows the condition of the child; he very carefully repeats digital vaginal examination, so that he may be fully assured as to the presenting part and its position; and if any doubt remains, let him introduce his hand into the vagina, when he can, by feeling the ear of the fœtus and observing the direction of its convex border, at once know both presentation and position. He will require at least two assistants, for example, the nurse and the husband of the patient; but more may be needed, "according to the difficulty of the operation, or the indocility of the patient."

Operation. This includes three acts: (1) the introduction of the blades of the forceps; (2) locking the branches; and (3) extraction. The instrument having been first made aseptic and warmed by dipping each branch into a warm solution of carbolic acid or creolin mixture, the abstetrician applies to the external surface of each blade carbolized cosmoline, vaseline, or oil, and similarly anoints the fingers of his right hand.[1] As locking is effected when the right branch rests upon the left, the general rule is to introduce the left blade first—"left blade, held in the left hand, and always passed in the left side of the mother's pelvis"—and accordingly this is taken in the left hand, the thumb being placed upon the inner, the fingers upon the outer surface near the lock; the grasp should be firm, secure, but gentle. The obstetrician takes a convenient position, for example, either sitting or standing between the patient's knees, if she be lying across the bed; introduces two, or if the head be high up four, fingers of the right hand into the vagina, and if possible brings their tips in contact with the margin of the mouth of the womb, and thus the fingers are made to guide the course of the forceps blade, and to guard the maternal parts, saving them from injury. The point of the blade is now made to enter the vulval orifice, the handle pointing upward and to the right, the blade "sinks by its own weight into the perineo-sacral gutter," its convexity presses against the inner surface of the introduced fingers, its concavity adapts itself to the fœtal head; with the ascent of the blade, which should be assisted by gentle pressure with the left hand, and its concave surface kept in contact with the fœtal head by the fingers of the right hand, the handle moves downward and to the left, so that it becomes nearly horizontal, and in the median line. Here the question arises, should the forceps be applied simply transversely with reference to the mother's pelvis, or to the sides of the child's head? Many British and German obstetricians hold to the former, while the general teaching of the French and American is in favor of the latter. Of course, when the head is low and internal rotation has occurred, the mode of application necessarily meets both requirements; but the difference of methods comes when the head is high. The arguments in favor of placing the blades upon the sides of the child's head are, that the sides are the only parts that are sym-

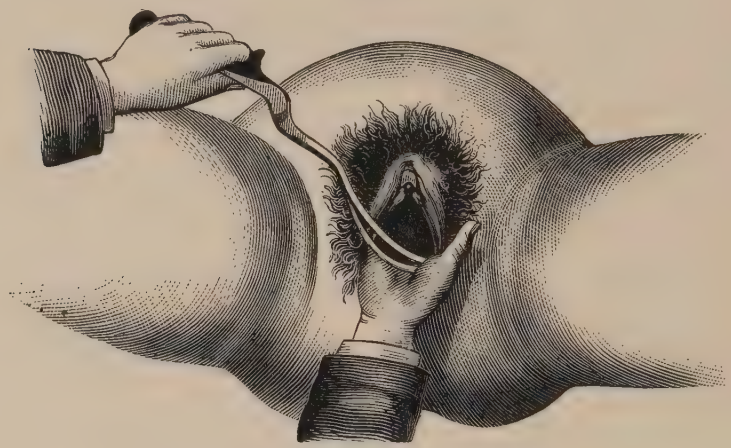
thumb and index-finger of the right hand and made rhythmic traction, at the same time the left hand beneath the back of the chest alternately elevated and depressed the thorax at intervals corresponding with tractions upon the tongue—twenty-four a minute. After twenty minutes the child gasped, and in about thirty minutes breathed and cried."

[1] If the creolin mixture is used, ointment or oil may be dispensed with.

metrical—the only parts, if labor has been in progress for some time, that lie in the same plane, and to them only are the concavities of the blades accurately adapted. The last remark applies especially to the Davis forceps, and if one prefers applying the forceps transversely in the mother's pelvis, without reference to the position of the fœtal head, he will select an instrument having a wide interval between the blades, such as that of Simpson.

Whichever method is adopted, the obstetrician bears in mind that the blade is to be introduced gently, not forcibly—gliding, feeling its way to the proper place; decided resistance to its progress proves that the direction is wrong, and therefore must be changed; the words *arte non vi*, which Blundell suggested, should be engraved on one of the forceps blades, should not be forgotten in their introduction.

Fig. 248.

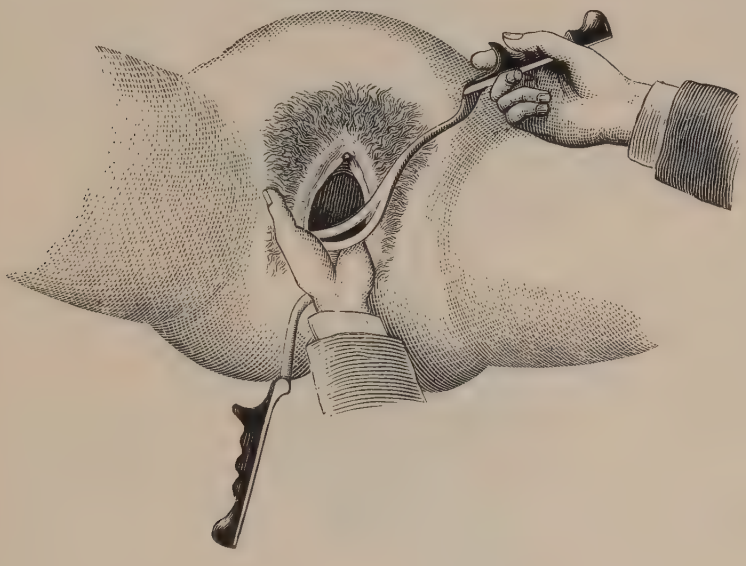


Introduction of the Left Blade of the Forceps.

After the first blade is placed in position its handle is given in charge of an assistant, while the obstetrician introduces the second blade. The latter takes the right branch in his right hand—right blade, held in the right hand, and introduced into the right side of the mother's pelvis—and using the fingers of the left hand in a similar manner and for the same purpose that those of the right were used when the first blade was introduced, the second is placed on the opposite side of the child's head. When the operation is completed, the right handle rests upon the left, and they are usually locked without difficulty. Such difficulty may occur either because one blade has been introduced farther than the other, or because the handles are not in the same plane. The difficulty in the first case is removed by pushing the one blade farther in, or slightly withdrawing the other. If the handles are found to be in different planes, each handle is grasped by a hand, and the operator gently rotates the blades in opposite directions; if this fail to make the handles parallel, the second blade is removed and reintroduced, and if failure still follow, both blades must be taken out, and the effort made to introduce them so that the proper relation shall be secured. If, with some

difficulty in locking, it is afterward found that the handles cannot be approximated, but stand widely apart, this may result from the head being irregularly grasped, or from its being of unusual size, or from the blades not having been passed far enough over the head. In the last case it often happens that, if the handles are thus left without effort to bring them together—the blades, of course, being correspondingly separated—a few vigorous uterine contractions will force the head farther down in the embrace of the blades, and the difficulty is ended. Irregular seizure of the head—as, for example, that in which an oblique occipito-frontal diameter instead of the biparietal lies in the transverse diameter of the blades—is necessary in some cases; the operator recognizes this condition, and makes no effort to force the handles together,

FIG. 249.



INTRODUCTION OF THE RIGHT BLADE OF THE FORCEPS.

remembering the golden rule as to compression; let it only be sufficient to keep the instrument from slipping. The difficulty in approximating the handles is always great, even insuperable in case of a very large head, and it is possible that the instrument may slip after the most careful application, when this method of delivery may have to be abandoned.

A mistake which I am sure is not infrequently made, is failure to introduce the blades far enough, and then, for example, they lie in the direction of the occipito-frontal instead of the occipito-mental diameter.

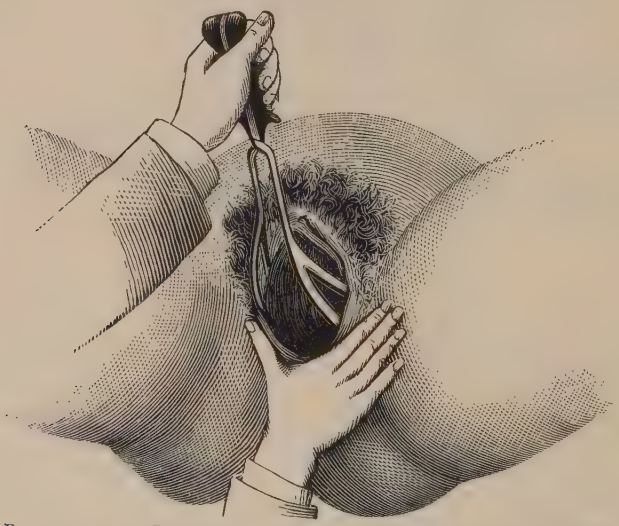
Care must be taken in the locking that hair or folds of skin of the external genital organs are not caught in the lock.

The readiness with which locking occurs, the approximation of the handles, the firmness and fixed state of the forceps, the instrument and

the head making for the time being a unit, indicate that the blades are in the proper position. That these include nothing more than the head—no prolapsed cord, or projecting border of the uterus, and no vaginal fold—has been guarded against by the careful manner of their introduction; but if there be any possibility of such an accident having occurred, the sole means of resolving the doubt is to "introduce one or two fingers to the level of the blades, as well in front as behind."

The traction, as before stated, should, as a rule, be intermittent; full force must not be employed at first; it may not be necessary at all, but if required it should be reached gradually; pulling with the forearms, or with one of them at first, the arms being by the side, is a practice that has been advised. Usually, if the power be given the right direction, it need not be great; in rare instances the accoucheur has to exert considerable force, but it must be his own, unassisted by that of another. In some instances the operator may find an immediate forceps delivery carrying greater danger to the mother and to the child, or both, than will a delay until nature's forces have moulded the fœtal head, thus facilitating the transmission through the birth-canal, and therefore the effort at instrumental delivery must be postponed until such moulding has occurred.

FIG. 250.

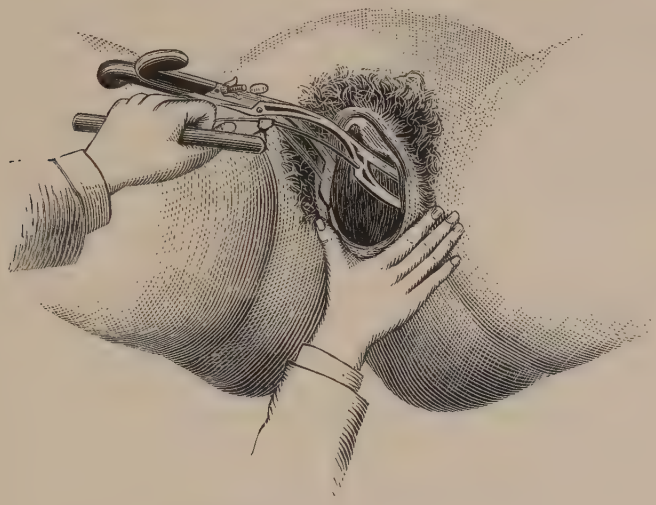


PROTECTING THE PERINEUM IN DELIVERY WITH THE COMMON FORCEPS.

Should the forceps be removed before the head is delivered? Such removal has been strongly recommended in recent years by Freund, Goodell, Lusk, and others and was the practice of Taylor, of New York, for many years before his death. It is the revival of an old practice. "Among the German authors, Boër, and after him Joerg, Carus, and others, have recommended removing the forceps as soon as the head is engaged in the vulva, if there is no indication for the immediate termination of the delivery." (Naegele and Grenser.) Madame Lachapelle strongly advocated this plan. The object sought by the removal is to prevent injury to the perineum by thus taking away the addition to the head circumference caused by the blades of the forceps. The objections that have been made to this practice are, that while the accoucheur is removing the instru-

ment a violent contraction may suddenly expel the head, and he being otherwise occupied, is powerless to give any protection to the perineum; or nature's forces, on the other hand, may be unequal to the expulsion, and a reapplication of the forceps be necessary. Moreover, we have in the forceps the best means of retarding the exit of the head until the vulvar orifice is sufficiently dilated, and at the same time giving it proper direction when that exit is made; the forceps may be used so that the perineum will suffer less injury than in normal labor.

Fig. 251.



Protecting the Perineum in Delivery with Tarnier's Forceps.

After this general consideration of the application of the forceps, next will be presented the method in which the instrument is used in different presentations and positions.

Head-first Labor. Cranial Presentation, and (1) Occipito-pubic Position. In this position the head was so small that it entered the inlet with its occipito-frontal diameter in relation with the antero-posterior of the former, instead of with one of the obliques or the transverse; or, and this is the more frequent case, anterior rotation, instead of direct descent, has placed the occiput at the subpubic ligament, or in the pubic arch. The blades of the forceps are necessarily placed in direct relation with the sides of the mother's pelvis, and upon the sides of the child's head. In a primipara the nearer the head is to the vulvar orifice, the more difficult the introduction of the guiding fingers, but this introduction need go no further than the parietal protuberances, for if the rim of the os uteri has cleared these it has retracted as far as the child's neck; passing the blades deeply in is unnecessary, and may do serious injury. After locking, which is easily done, the traction should be somewhat downward at first, if the occiput has not come in front of the subpubic ligament; but if it has, or after it has been brought thus in front, the handles are gradually raised so as to assist deflection, the occipital end of the long head diameter being outside the pelvis, and the normal delivery of the head taking place by a rotation

upon its transverse axis through the arc of a circle, suboccipital diameters measuring the distance from the lower margin of the pubic joint to the anterior margin of the perineum. Care must be taken to observe this normal mechanism in forceps delivery. If immediate extraction of the child is not imperative, let the head be held back until the parts are sufficiently dilated, and gradually lead it out, the nucha being made to hug the subpubic ligament. At the end of the extraction of the head, the handles of the forceps will be near to and almost parallel with the mother's anterior abdominal wall. Only one hand is needed for the forceps, and the other should be used to note the condition of the perineum and to protect it from being torn.

2. Occipito-sacral Position. After the application of the forceps, the pull must be upward and somewhat forward, increasing the head-flexion, until the occiput emerges over the anterior margin of the perineum, and then the head is delivered by extension, the nucha pivoting upon the anterior border of the perineum.

Some accoucheurs, among whom Charpentier may be mentioned, always attempt anterior rotation, and it is only when this attempt fails that delivery over the perineum is accepted.

3. Left Occipito-anterior Position. Supposing the head to be in the pelvic cavity, the left blade, which is introduced first, is passed to the left side, and posteriorly, so that it corresponds with the left sacro-iliac joint; very frequently the introduction of this blade determines anterior rotation of the occiput, and then the position is simply occipito-pubic, so that the introduction of the second blade is the same as has been described. But when this rotation does not occur, the right blade is "directed at first below, to the right and posteriorly, then brought by a very extensive spiral[1] movement to the level of the right ilio-pectineal eminence." After the blades are applied and locked, traction with anterior rotation, and delivery of the head as in occipito-pubic position follows; no attempt at rotation, however, should be made until the head has reached the pelvic floor.

Should the head be at the inlet, still the effort must be made to place the blades at the sides of the head. The simple rule given by Pinard applies in common to these, and to all oblique or diagonal positions which the head may occupy in the pelvis. Place the two blades at the two extremities of the empty oblique diameter; by such diameter is meant that in which the transverse diameters of the head are, and especially the biparietal, because this diameter does not occupy all its extent, there being always a space left between the former and the pelvis.

[1] This is known as the method of Madame Lachapelle, and has been described by her as follows: "If the branches are to be placed diagonally, that is, one behind on one side, the other in front upon the opposite side, it will suffice to pass directly the branch which ought to remain posteriorly over the sacro-sciatic ligament—nothing arrests it. The other can be easily managed, if I commence with it. Held in the hand as a pen, and leaning it across over the opposite groin, I insinuate the point of the blade in front of the sacro-sciatic ligament, then as it enters further I lower the handle, bringing it by degrees between the thighs, until it inclines strongly below. By this movement I have made the end of the blade describe a spiral, which the fingers in the vagina direct and complete. This movement carries the blade at the same time in front and above. It is necessary to encircle the head by an oblique passage, which represents a line extending from the sacro-iliac ligament to the horizontal ramus of the pubes, and traced on the interior of the basin. The movement is effected in the twinkling of an eye, without the least pain, without the least bruising." The spiral movement is not to be employed in cases in which the head has not entered the inlet.

Winckel teaches that even if the head is transverse in the pelvic inlet it is necessary to apply the blades of the forceps to the oblique diameter, and he regards it as a mistake to apply one blade over the brow and the other over the occiput, because the child is thus easily injured, and besides the antero-posterior diameter of the head is too large for the cephalic curve and the instrument easily slips off.

Dr. Fry, of Washington, at the meeting of the American Medical Association, 1889, showed a forceps invented by him for application to the sides of the head when it was transverse with reference to the pelvis, that is, in the antero-posterior diameter of the latter, and reported cases in which he had successfully used the instrument.

Milne Murray,[1] from experiments made with the cephalotribe upon the heads of dead fœtuses, concluded that the fœtal skull is compressible in an antero-posterior direction by the sliding of the occipital and frontal bones under the parietals; and that the compression is not accompanied by any appreciable increase of the transverse diameters. Thus in a minor degree of flat pelvis in which forceps delivery is indicated, the blades may be applied over the ends of the antero-posterior diameter.

4. Right Occipito-posterior Position. The introduction of the blades is done in the same way as in a left occipito-anterior position. The head is brought to the pelvic floor, then anterior rotation[2] attempted, which, if successful, requires removal, and then reapplication of the forceps; but if the attempt should fail, the occiput must be delivered over the anterior margin of the perineum.

5 and 6. Left Occipito-posterior Position and Right Occipito-anterior Position. The only difference in the introduction of the blades is, that in many cases it is difficult to introduce the second, right or posterior blade, after the first or left blade has been placed in position; hence, if this difficulty occurs, the right blade is introduced first, but of course the handles must be crossed before they can be locked. The difficulty may be obviated by following the method of Stoltz. After introducing the right blade, raise the handle and pass the left blade beneath it, and then the handles occupy their relative normal position without having to cross them after the application of the blades.

Ostermann[3] advocates if the head be transverse, or if it be oblique,

[1] Edinburgh Obstetrical Transactions, vol. xiii.

[2] It is claimed that in natural labor anterior rotation does not occur until the head has reached the pelvic floor. This statement is too absolute, for the rotation may occur before there is the least pressure upon that floor. But in artificial rotation, as made by the forceps, no effort should be made to this end until the floor is reached by the descending head. Traction should be made simultaneously with the effort to produce rotation, and it is important, too, that the forceps should be used to keep the head well flexed. Richardson, of Boston, very ingeniously applies the forceps with the anterior and posterior pelvic curves reversed, in order to effect rotation, removing the instrument as soon as the desired change has been accomplished, and then reapplying if necessary in the normal position of the blades. Barnes holds that instrumental rotation is only exceptionally useful, more rarely necessary, and is not free from danger.

The chief objection that is made to such rotation is that if the head be moved through more than one-fourth of a circle, the body being firmly held by the contracted uterus, and therefore not able to make a corresponding movement, injury is necessarily done to the spinal cord. The experiments of Tarnier and Ribemont have proved that this opinion is erroneous, for they have demonstrated that the torsion of the neck is distributed upon all the extent of the cervical column, and the first six or seven dorsal vertebræ. Tarnier states that exaggerated rotation exposes the spinal cord to injury less than does the great flexion necessary to be produced in order to deliver the occiput posteriorly.

Wasseige states (Des Opérations Obstétricales) that Van Huevel advised applying the new curvature of the forceps behind toward the occiput; as the blades only enter the excavation, it is, strictly speaking, possible, but, according to Wasseige, very difficult to execute, and he rejects it. The method differs only from that of Richardson in that after rotation is effected there is no removal and reapplication.

[3] Ueber combinirte Zangenextraction. Zeitschrift f. Geburt. und Gynäkol. Band. xxv.

that is, in an occipito-posterior position, left or right, anterior rotation, the forceps being applied to the head, and an assistant acting by manipulation upon the shoulders of the child through the abdominal wall. His success has been the best proof of the value of this method. Of course, if the rotation has been from a posterior position, the forceps must be removed and reapplied before extraction.

In connection with Ostermann's method of anterior rotation of the occiput, the methods advised in two recent works will be mentioned, though they should have occupied a previous place. Grandin and Jarman[1] say: "With the cervix fully dilated the hand is introduced into the uterus. If the head has slightly engaged, it should be gently pushed up. The fœtus is now grasped and slowly rotated in its long axis until the occiput is anterior. The hand should be slowly withdrawn until the head can be grasped, and in this position the operator waits for uterine contraction. When this has occurred the head is driven down and engagement ensues. It is wise to retain the hand until two or three contractions have taken place, so that the head may be firmly engaged."

Herman,[2] after stating that the diagnosis of the position ought to be made by abdominal palpation early, and that anterior rotation of the occiput can easily be accomplished before the rupture of the membranes, proceeds as follows: "Suppose that the child's belly looks forward and to the left, its anterior shoulder will be to the right and in front. Standing by the side of the patient, put your hands on the abdomen, the right hand behind the child's anterior shoulder, the left hand in front of the posterior shoulder. Then by a repetition of gentle pushing movements push the anterior shoulder over toward the left side, and the posterior shoulder toward the right side. You will find it quite easy to move the child; only, as the pushes are given, not to the child, but to the uterus, part of the effect is to move the uterus. But a sufficient repetition of these movements will, unless the liquor amnii be unusually deficient, or the child's mobility for some other reason be abnormally restricted, bring the back in front."[3]

Application of the Forceps in Head-last Labors. Manual delivery is to be preferred if possible. Winckel regards the forceps as indicated only in those cases in which the mouth cannot be reached, the occiput has rotated posteriorly, and the face remains stationary under the symphysis. Schröder rejected the forceps, believing that if manual traction could not succeed, it would be impossible with the instrument to extract a living child, and that it was dangerous for the mother. Budin regards the failure to deliver by manual means, which is quite exceptional, as in most cases due to contraction of the os uteri about the neck and head of the child, or to resistance of the pelvic floor, and that under such circumstances the forceps should be used.

In the application of the instrument, the occiput being in front, the child's body is raised, its back toward the mother's abdomen, and the forceps blades applied to the sides of the child's head and extraction made, the mental end of the occipito-mental diameter coming out first. But if the occiput is posterior, the child's body is raised up, its abdomen toward the mother's, the instrument applied as before, and now the occipital end of the occipito-mental diameter passes out first.

Head Movable Above the Inlet. In case the forceps is applied before the head has entered the inlet, an application which should be avoided if possible, an assistant holds the head by suitable pressure

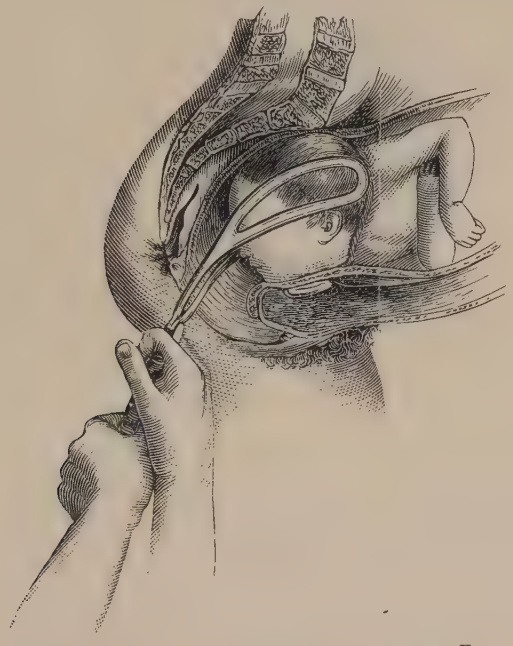
[1] Obstetric Surgery, 1894. [2] Difficult Labor, 1894.
[3] Before the practitioner is in haste to adopt this treatment, he should remember that it is only in rare exceptions anterior rotation does not spontaneously occur.

upon the lower portion of the mother's abdomen during the application of the blades. Almost invariably one blade passes over one frontal protuberance, the other over the side of the occiput obliquely opposite; thus, the first blade over the right side of the frontal bone, the second blade over the left side of the occipital bone. If the head cannot be brought into the inlet after a few vigorous efforts, some other method of delivery must be resorted to.

HEAD SEPARATED FROM THE TRUNK. It may happen, by "accident or by design," that the head has been detached from the trunk and remains in the uterus after the latter is delivered. Removal by the forceps is "delicate and difficult," and should not be resorted to unless other means, such as the use of the hand and the assistance of uterine contractions, have failed. Make the head fixed, by pressure through the abdominal wall or by seizing the head with a hand introduced into the uterus, and apply the forceps to the sides of the head.

THE FORCEPS IN FACE PRESENTATION. In presentations of the face the chin must rotate anteriorly if the labor ends naturally; the

FIG. 252.

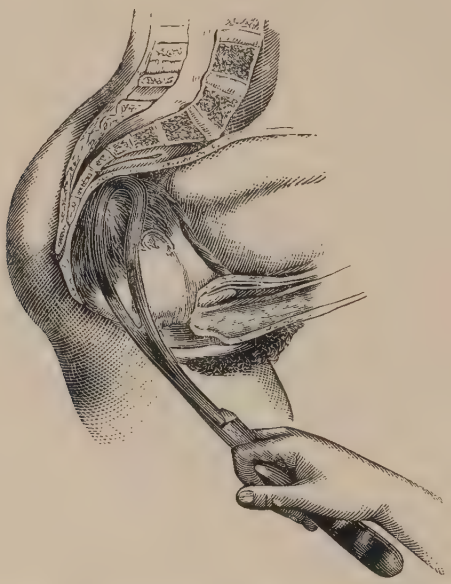


APPLICATION OF FORCEPS IN PRESENTATION OF THE FACE.

chin in this movement takes the place of the occiput in vertex presentations. While anterior rotation is the rule in the latter, yet delivery is still possible by Nature's unaided efforts, even should the occiput rotate posteriorly. Not so, however, as to the movement of the chin in a face presentation, for anterior rotation is essential for delivery. It should, therefore, be remembered that, in the application of the forceps, the instrument is valueless if such rotation cannot be effected. The difficulty

and the danger of the forceps application to the head above the inlet lead obstetricians to greatly prefer conversion of a facial into a cranial presentation, or podalic version. But when descent into the pelvic cavity has occurred, and the chin is right or left anterior, either as a primitive position, or as resulting from rotation from a transverse or a posterior position, the application of the forceps and extraction are no more difficult than in similar positions of the occiput. The same rules are followed as to the introduction and articulation of the blades in the one case as in the other; but in facial presentations it is especially imperative that the blades be upon the sides of the child's head; departure from this rule, as, for example, applying one of the blades in the trachelo-bregmatic diameter, would give an insecure hold, and probably do irreparable mischief to the child's throat.

FIG. 253.



DELIVERY BY THE FORCEPS IN PRESENTATION OF THE FACE.

After the application of the forceps in a mento-anterior position, extension and rotation of the chin into the pubic arch are the movements at first to be executed, and then the delivery of the head is accomplished by flexion; "care must be taken in this last step to prevent too long compression of the vessels of the neck against the pubic joint."

In mento-posterior positions, either right or left, the mode of application of the forceps-blades does not differ from that employed in corresponding occipito-posterior positions, and therefore need not be repeated. In transverse positions, if the forceps be used, the rule as to the application of the blades to the sides of the head is necessarily departed from, and an oblique application is made in which "one blade is placed upon the cheek and the base of the jaw, while the other is upon the temporo-occipital region of the opposite side."

"One ought not to apply the forceps except in case of absolute necessity, in presentation of the face; for an accouchement which may end spontaneously and favorably is sometimes arrested when its march is disturbed by untimely attempts; the operator acting rashly, if he fails in his attempts, regrets too late the resources which would have been found in prudent expectation." (Tarnier.)

The changing of a face into a vertex presentation by means of the forceps has been recommended. In this proposed method the chin is directed toward one of the great sciatic foramina, where, by pushing before it the soft parts, it was thought that sufficient room might be obtained for the rotation of the occipito-mental diameter, so that descent of the occipital, with ascent of the mental, end might be obtained. This could only succeed if the pelvis were large and the head small, so that any attempt to accomplish it is but a forlorn hope.

Dr. Hodge thought that it might occasionally be practicable to deliver a living child, if the head were small and the perineum greatly relaxed, by applying the forceps, when the chin had rotated posteriorly, as accurately as possible in the direction of the occipito-frontal diameter, and drawing the head down, then causing the occipito-mental diameter to revolve between the anterior margin of the pernineum and the subpubic ligament. Some cases are on record in which a living child has been delivered in a direct mento-posterior position, either spontaneously, or after the application of the forceps; but they are simply rare exceptions to a general law, and the rule in such positions is craniotomy.

Application of the Forceps in Presentation of the Pelvis. If the child be dead, the blades may be placed simply upon the sides of its pelvis, and firm compression made without reference to possible injury to the bones; but if it be living, there ought to be interposed between the handles of the ordinary forceps, according to Pinard, something that will prevent their coming too close together, and thus avoiding injurious compression. Pinard directs the blades to be applied as far as possible, so that the pelvis may be seized by its bisiliac, or bistrochanteric diameter; nevertheless, he states that he has seen Tarnier with his forceps seize the pelvis by the sacropubic diameter, the genital organs being in the fenestra of one of the blades, and extract an infant without causing any lesion. The blades ought not to pass the iliac crests, lest injury be done the abdomen. The extraction must be made slowly.

Accidents and Dangers in the Use of Forceps. The blades may slip, the liability to this accident being greater if the head is high; slipping usually occurs because the blades have been improperly applied, or because the pulling is in the wrong direction. Madame Lachapelle describes two varieties of this accident, vertical and horizontal. The first may occur when the head is high, so that it recedes during the application of the blades, and hence is incompletely and thus insecurely grasped; or it may happen that the operator, misled by a large caput succedaneum, does not introduce the blades far enough; the handles do not readily approximate, or their points embrace one of the transverse diameters of the head. So, too, the accident may happen from the head being so small, or having so little firmness that the forceps cannot hold it. Horizontal slipping occurs when the blades imperfectly seize the head, being too far to its anterior or to its posterior surface, and it is held only by the posterior or by the anterior pelvic curvature of the instrument; this condition may be recognized by the easy approximation

of the handles. The consequences of the slipping, when vigorous traction is made, are the sudden escape of the instrument from the pelvis, with more or less injury to the mother's soft parts and to the child, and the operator may find himself prostrate on his back. The obstetrician guards against this accident by observing whether the part of the fœtal head nearest the lock is receding, the beginning of the blades becoming visible without the handles taking the usual direction, and the blades appearing empty, while the forceps is "getting longer." The moment any indication that the blades are slipping occurs all traction should cease, the instrument be unlocked, and the blades passed further in.

It has sometimes happened that one of the blades is pulled straight, the head curve being quite lost. Elliot describes this as having occurred with him in using a Simpson forceps; and I know of a recent case in which this accident happened with a Hodge forceps, the delivery of the child being very readily effected afterward by the use of McFerran's axis-traction forceps. It is probable that the accident occurs from a want of proper direction of the traction, or from too great effort to force a delivery before the head is sufficiently moulded.

Injuries to the Mother by Forceps. Among the dangers of the forceps to the mother are prolapse of the uterus or lacerations of the cervix; if great traction is made before the dilatation of the os, the lower uterine segment may be dragged down, torn, or seriously bruised; the vaginal vault may be penetrated by the forceps-blade, or the vagina may be torn elsewhere. Spiegelberg mentions an instance he knew, in which the anterior vaginal wall was torn from the fornix down to the lowest portion of the urethra. "Severe compression of organs contained in the pelvis may lead to inflammation ending in suppuration or gangrene, causing fistulæ, abscesses and partial paralyses;" injuries of the external generative organs and laceration of the perineum; fractures of the pelvis or separation of pelvic joints; finally, a rapid forceps delivery may, if suitable care be not taken, lead to post-partum hemorrhage.

Injuries to the Child by Forceps. The minor ones are abrasions, bruises, or even cutting the scalp, the cutting sometimes reaching the subjacent bone. Depressions and even fissures of the bones may be produced. Injuries to the brain have been reported, immediately fatal results sometimes ensuing, while at other times remote evil has been ascribed to the instrument. Winkler and Ballaan[1] attributed the idiocy of two subjects of whom they made autopsies to cerebral atrophy caused by pressure of the forceps at birth. Ahlfeld regards it, while not proved, as not improbable, that children delivered by the forceps, in later life are more liable to psychical diseases and epilepsy. Dr. Horatio C. Wood has said:[2] "The brain at birth is so soft, so liable to injury that while I would not have the obstetrician entirely discard the use of the forceps, I think he should never take the instrument in his hand without bearing in mind the possibility of doing serious permanent injury to the nerve centres of the child."

[1] Centralblatt f. Gynäkol., 1889.
[2] From remarks made in the discussion of author's paper upon Injuries to the Fœtus During Labor, read before the Philadelphia County Medical Society. Medical and Surgical Reporter, 1887.

Charpentier states that he has seen, as a consequence of an application of the forceps by an inexperienced operator, one of the branches pushed with such violence that the blade penetrated the scalp near the occiput, passing as far as the root of the nose, detaching in its progress the skin from the cranium; the child died at the end of forty-eight hours. I have observed a similar case; the operator had passed one blade on the outside of the scalp, but the other was applied beneath the scalp, when the difficulty in making it penetrate far enough led him to ask professional assistance; fortunately, the child was dead.

Intra-cranial effusion of blood may occur, oftener, as suggested by Spiegelberg, not from the direct compression of the forceps, but indirectly from drawing the head rapidly through the narrow birth-canal. Paralysis of the facial nerve, usually on one side only, in rare cases on each side, may occur from direct pressure by the forceps-blade upon the nerve-trunk; the compression may be of one of the branches only, and then the paralysis is only of the parts supplied by it. Generally this paralysis disappears in one or two weeks without treatment, but in some instances it lasts for years, and then may be regarded as incurable. So, too, the brachial plexus may be injured by the point of one of the blades, and paralysis of the parts supplied by it result.

I have seen a case in which forceps extraction was made, one of the blades being applied partly over the frontal bone, and exophthalmus resulted; the child was dead, and the mother perished a few days after of septic infection.

Pincus[1] attributes some cases of injury to the sterno-cleido-mastoid muscle to improperly constructed forceps and to torsion. The last fact should be borne in mind before attempting to compel anterior rotation in an occipito-posterior position.

While the obstetrician will neither resort to the forceps "from complaisance, nor reject it from cowardice," he must be quite sure that the interests of the mother or of the child, or both, demand the use of the instrument, and that the conditions are present rendering that use safe.

THE VECTIS. This instrument is supposed to be, like the forceps, the invention of Chamberlen. The instrument has been given different

FIG. 254.

THE VECTIS.

forms, according as it was used chiefly or exclusively as a lever or as a tractor; thus Roonhuysen's instrument was a plate of steel, slightly curved, but the form preferred by the few obstetricians who use the instrument is that of a fenestrated, curved blade, with a straight handle; Spiegelberg has briefly referred to it as being one blade of the forceps, and therefore an unnecessary instrument. Lowder's instrument, of which an illustration is given, is probably the best. It has been used chiefly to increase flexion and to assist rotation, but is rarely employed and by but few obstetricians at the present day.

[1] Zeits. für Geburt. und Gynäk., 1895.

CHAPTER XII.

MANUAL REMOVAL OF THE PLACENTA—SYMPHYSEOTOMY.

MANUAL REMOVAL OF THE PLACENTA. If the placenta is not spontaneously expelled within two hours after the birth of the child, and if by stimulating uterine contractions, by manipulation through the abdominal wall, assisted by moderate traction on the cord, it is still retained, its removal by the hand is usually indicated. In order to guide the hand that is to enter the uterus into the os, and also to the position of the placenta, the other hand pulls on the cord, so that it is made moderately tense. The hand, after proper preparation—washing and antiseptics—is passed in a cone-shape, the fingers and thumb brought together so that the cone is formed, into the vagina, thence into the uterus and the placenta found, and then the other hand, no longer required to pull upon the cord, is placed upon the abdominal wall, so that the uterus is grasped by it. The placenta is detached, partially detached, or completely adherent. In the first case the operator includes as much as he can of it in his half-folded hand, not instantly withdrawing placenta and hand, but rather invites by the irritation of the hand within and by friction and compression of the hand without, uterine contraction which tends to expel both hand and placenta. In the second case, that is, in partial detachment of the placenta, there is no hemorrhage if the womb be well contracted; but even if there be no bleeding, still more if there is, the placenta is to be completely detached, this separation being effected by continuing the separation from the part where it has begun; in this manipulation, supposing the right hand to be in the uterus and the placenta to be situated upon the posterior wall of the uterus, the ulnar border of the hand is used with a sort of sawing motion, or like the continuous movements made in using a paper-cutter, the back of the hand being toward the uterine wall, and the external hand keeping the uterus in position, and assisting in defining the uterine wall so that the internal fingers do it no damage. If the placenta be situated upon the anterior wall, then the radial margin furnishes the edge of the paper-cutter; but if the attachment be to the fundus, the ends of the fingers must make the separation, being careful that they turn toward the soft placenta rather than toward the harder uterine wall, and thus harm to the latter is avoided. Of course, all manipulations must cease during a uterine contraction. If the placenta be completely adherent, the method of removal does not differ, but is more difficult. It ought to be added that an adherent placenta is very rare; that is, pathological adhesion, in consequence possibly of endometritis, is very seldom in occurrence. Hildebrandt advised separation within the fœtal membranes, these being made to form a glove-like covering for the operating hand, on the

ground that thus avoidance of injury to the uterine wall was secured, and also danger of septic infection avoided. Spiegelberg found the method successful only in case the attachment was not strong, and that the assistance derived from tactile sensations was greatly diminished by this method. Budin advises, if the hand has entered the fœtal sac, to tear the membranes at the border of the placenta, so as to begin the separation there; if this fails, then the placenta is penetrated near its centre, and the fingers introduced into the button-hole thus formed, and the separation made with them, making a circle from this starting-point between the placenta and uterus. In case hour-glass contraction is present, or a similar contraction at one of the uterine cornua holds the placenta imprisoned, it may be the stricture can be overcome by a hypodermatic of morphine and chloroform inhalation, then dilatation with one, two, three, four fingers, until finally the hand enters, or dilatation with Barnes's hydrostatic dilators may be successful. If these means fail, Budin's answer is antisepsis and patience. Certainly the condition of the woman is one of imminent peril; but by the use of antiseptic washes and suppositories we can materially lessen that peril, and, in many instances, the patient waiting is followed by the spontaneous detachment and expulsion of the placenta.

Chazan,[1] who, in correspondence with the views of obstetricians generally, regards placental retention as in almost all cases failure of placental detachment, this failure not indicating abnormal adhesion—has for many years abandoned the usual treatment, stating that he has been quite successful pursuing another plan. A firm and continued pull upon that part of the placenta which has been detached—usually there is such a part—will cause the detachment of the entire afterbirth. In most cases it is not necessary to pass even the fingers into the uterine cavity, for the separated portion will be found in the cervical canal, sometimes indeed in the vagina. Exceptionally this portion is central instead of marginal, and then the finger bores through that part of the placenta, and using it as a hook detaches the rest of the placenta by pulling on it.

SYMPHYSEOTOMY.[2] By this is meant section of the pubic joint to facilitate or render possible the birth of a living child in stenosis of the pelvis.

HISTORICAL. Paré[3] stated he had heard it said that in Italy the pubic bones were broken in young girls for the purpose of facilitating labor. It certainly was a strange rumor to be credited by the great French surgeon. Delacourvée, a French physician living at Warsaw, in the year 1655 divided the symphysis in a woman who died after four days' labor undelivered, and thus permitted the child, whose head had been wedged in a narrow pelvis, to be extracted. A similar operation was done by Plenck, in Hungary, in 1766. A French medical student—J. R. Sigault—made the subject of his inaugural thesis, 1773, a discussion of the question, whether in labor *contra naturam*, section of the pubic bones would not be more prompt and safer than the Cæsarean operation. Sigault was led to the advocacy of symphyseotomy by a memoir read by Louis before the Academy of Surgery, upon the separation of the bones of the pelvis. In 1777 Sigault[4] performed his first operation on a woman who was the

[1] Ueber Placenta retention nach rechtzeitiger Geburt., 1894.

[2] In employing this word I have complied, so far as the use of *e* is concerned, with the common usage of recent French and English writers. Nevertheless, Kossmann, Pathologie unserer Kuntsausdrüche, Monatsschrift f. Geburtshülfe und Gynäkologie, June, 1895, refers to it as a horrible word, and, probably, were we to use an accurate designation we would choose Symphysitome.

[3] For several of the facts here given I am indebted to Gotchaux's Monograph, De la Symphyseotomie, Paris, 1893.

[4] Most authorities state that this was the first symphyseotomy upon the living subject: but Kaltenbach says that the operation was done in Naples in 1774, by Domenico Ferrara.

wife of a soldier, and who had been pregnant four times previously, the children being dead. Child and mother were saved, but the latter suffered many years with a vesico-vaginal fistula. Four other operations were done by him, all of the children perishing, and in the last the mother also. From his first operation until 1800, that is, a period of twenty-three years, the operation was done thirty-four times, nineteen of these being in France.

The mortality of the operation was very great, and obstetric authorities were almost unanimous in condemning it. Nevertheless, though rejected in the country where it had its birth, symphyseotomy found occasional advocates in Italy during the first half of the present century; it is especially to the Naples school that the profession is indebted for the preservation and improvement of the operation. Of that school, no one has done so much to establish the value of symphyseotomy as Morisani, whose first operation was done in 1879. The next most prominent Italian name connected with the revival of the operation is that of Mangiagalli, of Milan. The operation has been received with much favor in France, and, owing chiefly to the careful researches and contributions of Dr. Robert P. Harris, also in this country; many prominent German authorities accept it, but in England its progress has been slow.

Morisani, at the International Congress, in Rome, 1894, asserted that by symphyseotomy a well-developed fœtus at term can pass through a pelvis narrowed between the limits of 67 to 88 millimetres. These additional statements were made by him. As a rule, the operation should be done at term, after labor has begun and dilatation advanced. It is not a good operation if the fœtus is dead or seriously compromised; nor is it to be done in connection with induced labor; the forceps may be used, but it is not indispensable; finally, in some cases it may be done in connection with embryotomy if the fœtus is dead.

So far for the position assigned symphyseotomy by its chief living promoter. All do not accept the teaching of Morisani. Sänger, for example, with twelve Cæsarean sections and no death, believes symphyseotomy should be more restricted, and greater extension given the former operation. Leopold would, if possible, avoid it in primiparæ; and in multiparæ, if the conjugate is only seven centimetres, induce premature labor; if too late, no interference at first, and if the labor does not terminate naturally, version for it is possible in the flat pelvis with a true conjugate of seven centimetres, and in a generally contracted pelvis, the conjugate being seven and one-half centimetres, to deliver a child of mean volume at term.

Of course, the extravagant claim for Walcher's[1] position, that by it in many cases symphyseotomy will be superseded, can find but little acceptance.

Ahlfeld regards determining the indications as quite complex, and only possible for the most skilled obstetrician. He further believes that the operation has been in late years often done unnecessarily and for the love of operating. He also states that the next years must teach us how many women are injured by the operation, and remain injured, and also as to the result in private, compared with hospital practice.

In conversation with Professor Olshausen last summer he expressed the opinion that the operation was one for the hospital.

Among the dangers of the operation are severe hemorrhage, tears of the urethra, bladder, or vagina; septic infection, inflammation of the joint may follow, or there may be a failure of firm union. Yet, it is to be remembered that such results are exceptional, and can usually be averted.

Mortality. Neugebauer's statistics, from 1887 to the end of 1893,

[1] Those who will read Varnier's criticism of the claim, Annales de Gynecologie, December, 1894, will accord small importance to Walcher's position.

include 278 operations, and there were 31 deaths. Several died from pneumonia, two from hemorrhage, and in a patient of Chrobak's the record is "purulent endometritis, rupture of the urethra, of the vagina, and of the neck of the uterus, septicæmia, anæmia, and rupture of both sacro-iliac joints."[1] Nevertheless, the majority of deaths were from septic infection.

Harris[2] states that the operation has been done in the United States, in fifteen years, 74 times; 10 women and 18 children perishing. Uniting the American cases with those of Neugebauer for 1892 and 1893, he finds the percentage of maternal deaths over 11; that of symphyseotomies in Canada and the United States he states is more than 12.

Operation. There are different methods of operating, but the chief ones, those generally employed, are that of Morisani, and that of Pinard, and these only will be described.

Morisani has the patient lying at the edge of the bed, in the position for obstetric operations, while the operator is directly in front; she is anæsthetized. Having shaved and carefully disinfected the genital parts and the hypogastrium, a metallic female catheter is introduced into the bladder; then an incision is made two to three centimetres long vertically just above the symphysis; the retro-pubic tissues are detached after the incision has penetrated to the superior border of the articulation; in this separation of the tissues, the operator keeps his finger close to the posterior surface of the symphysis. By the way thus made Galbiati's sickel-shaped knife, a strong bistoury, probe-pointed and curved upon the cutting-edge, is introduced. The knob is passed below the inferior border of the articulation, upon which the cutting curve of the instrument is now brought; then, by movements of the wrist, the joint is divided from below above, and from behind in front. He further states that he has sometimes, instead of Galbiati's knife, used a probe-pointed bistoury, with a short, firm blade, and opened the joint from before backward.

Pinard makes an incision eight to ten centimetres long, its lower end being above the clitoris, and slightly deviating in order to spare this organ and its vessels. Next the recti muscles are separated at the superior part of the wound, in order to permit the finger to enter into the pre-vesical cavity to protect the bladder and to feel the projection of the joint. "Then having a clear conception of the median line I cut the symphysis from above below, and from in front behind, by successive strokes of the bistoury, reserving the sub-pubic ligament until the last."

Arterial hemorrhage is met by ligature or torsion of vessels, and venous bleeding by tampon of sterilized gauze.

The separation of the pubic bones will be 6 to 8 centimeters, or two or three inches; too wide a separation is prevented by assistants pressing the trochanters inward, lest serious injury be done the sacro-iliac joints.

[1] Jahresbericht über die Fortschrift auf dem Gebiete der Geburtshülfe und Gynäkologie, i. for the year 1893.
[2] The American Gynecological and Obstetrical Journal, June, 1895.

If labor pains are active, delivery may be left to Nature; in the majority of cases, however, either version or the forceps has been employed. After labor is over the parts are thoroughly cleansed, and an antiseptic employed; then the divided parts are pressed together, and stitches of silk or of silkworm-gut unite the superficial incision, some, indeed, use silver-wire sutures to join the pubic bones, and an antiseptic dressing is applied; a firm bandage or adhesive straps are employed to keep the divided parts in contact. Plaster-of-Paris bandage, Martin's rubber bandage, or Esmarch's, and two bags of sand placed one on each side of the patient, are among the many means that have been employed to secure immobility of the separated bones.

The dorsal position is kept during the first week, and after that the patient may be changed to either side, when she desires it. In favorable cases the joint is so well united in three weeks that she may be permitted to sit up, and after a few days may walk.

Farabeuf's Operation, or Ischio-pubiotomy. In an instance of a pregnant woman having an oblique-oval pelvis, Naegele's pelvis, by the advice of Farabeuf Pinard performed ischio-pubiotomy—the bones of the anchylosed sides were divided—and a living child was born, the mother perfectly recovered. This operation was done in 1892.

CHAPTER XIII.

THE CÆSAREAN OPERATION AND ITS SUBSTITUTES.

By the Cæsarean section or operation is meant opening the abdomen and the uterus, and extracting the fœtus through the incision.

The operation performed after death is a very ancient one, having been established by the Romans as a law centuries before the Christian era, its purpose being to secure citizens to the State. The Christian Church strongly enjoined the operation, even when the mother's death occurred quite early in pregnancy. The first known operation upon the living subject was by Jacob Nuffer,[1] a sow-gelder, in 1500, the patient being his wife; she recovered, and afterward bore several living children. Kleinwächter states that the next operations were by Döring, 1531, and by Donat in 1549, and that the first operation in Germany was by Trautmann, in Wittenberg, in the year 1610.

Terms designating the Cæsarean Operation and its Substitutes. The term laparotomy[2] has been strangely perverted from its etymological and original meaning, and applied as part of a compound word to the Cæsarean operation, to that of Porro, and to that known by the name of Thomas. It will be better, while protesting against this great perversion, to replace the various compounds of laparotomy by correct terms, and thus the Cæsarean operation will be called gastro-hysterotomy; gastro-hysterectomy is the proper designation for Porro's operation, and gastro-elytrotomy, the name used by Baudelocque, is the appropriate one for the operation commonly called laparo-elytrotomy.[3]

Indications for Gastro-hysterotomy. These are absolute and relative. When there is such obstruction of the birth-canal, whether arising from uterine tumors or tumors of adjacent organs, or of the pelvis, or from conditions of the cervix or of the vagina, or from pelvic contraction, that even a mutilated fœtus cannot be delivered through the natural passage—the operation should be done.

In regard to pelvic contraction as furnishing an absolute indication for gastro-hysterotomy, we may accept the limits assigned by Winckel,

[1] The earliest history of this operation which I have had the opportunity of reading is given by Scultetus in his Armamentarium Chirurgicum, Frankfort, 1666. We have the picture of a woman at the end of her first pregnancy some days in labor without relief from Nature's efforts, or from the assistance of "thirteen midwives and several lithotomists." The husband, despairing of help from these means, suggests others to his wife, and she consents. Next he procured a license from the civil authority, and returning home, first addresses the midwives, exhorting them to be brave, but advising the timid to retire, and, as a consequence, eleven withdrew, only two remaining to assist him; the lithotomists also remained. He places his wife upon the table, implores Divine help, and then incises the abdomen *non secus ac alicui porco*. Almost immediately after the incision had been made a living child was extracted uninjured, and the woman made a rapid recovery.

[2] Laparotomie (from λαπάρα, flank, and τομή, section). Operation for lumbar hernia or for artificial anus, practised in the lumbar regions. Litré and Robin's Dictionary of Medicine, Surgery, etc.

[3] Cœliotomy has been proposed by Dr. R. P. Harris as an appropriate term for abdominal section, and it has been generally accepted by the profession in this country and by many abroad. Medical language so abounds with neologisms, that a new word, though correct and appropriate, should not be introduced unless absolutely necessary. It has been stated that the Arabic has a thousand names for a lion, but in science a synonyme, or an alias is seldom advisable.

and which have been quoted on a previous page, 2.6 inches conjugate in a generally contracted pelvis, and 2.1 inches in a flat pelvis. Yet embryotomy in pelves that approximate such narrowing will, in the hands of those who are not expert and possessed of the necessary facilities for operating, often if not usually prove more difficult and more tedious than abdomino-uterine section, or exsection. Nevertheless let these limits be recognized.

The relative indication is given by those pelves so contracted that a living child cannot be delivered at term, or by the induction of premature labor, or if the pregnancy has advanced beyond the time for the safe induction of labor. This question will be further considered under the head of embryotomy.

Time of, Preparation of Patient for, and Mode of Operating. If a choice of time can be made, it is preferable to do the operation about the end of pregnancy, but before labor begins. The patient is given a bath the evening before, soap being used with the water, and the skin thoroughly cleansed. The bowels are moved freely in the morning of the day on which the operation is done, the vagina thoroughly cleansed by an antiseptic injection, and immediately before operating a catheter is introduced so that it is certain the bladder is empty. The sub-umbilical region is shaved, the part washed with soap and water, then with ether or antiseptic solution. The lower limbs are each wrapped with a blanket or shawl, and the chest properly protected from cold. The operator has ready a bistoury, several hæmostatic forceps, sponges or antiseptic gauze, scissors, needles, needle-holder, silk of two sizes, rubber tubing—for encircling the neck of the uterus, if he prefers this method of preventing hemorrhage—a funnel to which a rubber tube is attached, and to the lower end of the latter a metal or hard rubber canula, for washing out the abdominal cavity, iodoform, iodoform gauze, antiseptic cotton, flannel bandage for the abdomen, safety pins, two hypodermatic syringes, ether, brandy, solution of ergotin, or fluid extract of ergot, and Tait's or other constrictor, as in preparation for hysterectomy, should this prove necessary. He must have, also, wire, and two long, thick needles. There must be at hand hot and cold water, basins and towels. The operating-table should be narrow; the operator is upon the patient's right side, and his chief assistant upon the left. The abdominal incision must be about six inches in length, and is made through layer after layer in the linea alba—there is no difficulty in finding this when the tissues are stretched as they are in pregnancy—hæmostatic forceps being used as required for bleeding vessels; as the peritoneum is approached, it is advisable for the operator and assistant to lift up the tissues to be cut, each with forceps, and the incision is made between the points of the two instruments. The abdominal cavity having been opened, the incision if not long enough is increased by scissors; then the uterus is brought out through the opening, and encircled below the ovaries and as close to the neck as possible by rubber tubing, and constricted, or, instead of this method of guarding against hemorrhage, an assistant compresses with his fingers the lower lateral part of the uterus. If the uterus is opened outside the abdominal cavity, a few sutures are introduced at the upper part of the incision so

as to close it partially, and thus prevent the escape of amnial fluid or blood into the peritoneal cavity. Next, the anterior uterine wall is incised in the median line—if the organ be *in situ*, an assistant presses it on either side of the abdominal wall so as to bring it close against the cut in the abdominal wall, and also corrects any obliquity which there may be. The operator will have in mind Leopold's statement as to determining the position of the placenta (see page 383); Winckel states we can distinguish previously, by the distinctness with which the extremities are made out, whether the placenta is attached in front or not. If it should be found in this position, we may change the place of incising the uterus. But if the discovery is not made until during the incision, there will be a startling gush of blood; this is only for a moment, and the operator does not delay an instant. The incision of the uterus completed, an assistant places the palmar surface of each index-finger at the ends of the opening, thus lifting up the uterus, and preventing its rapid retraction. Next the operator ruptures the membranes, introduces one hand into the sac, and the other hand assisting externally, brings the child out of the uterus, usually drawing forth lower limbs and hips first, shoulders and head last; if the incision in the uterus is not large enough for the child to pass through, it must be lengthened; when the child cries and breathing is established, the cord is divided, and after this it is put in charge of an assistant. The placenta and membranes are delivered through the wound; if not spontaneously detached, they are manually separated from the uterine wall. The open condition of the cervical canal is next secured, and the uterine cavity is washed out with a 1 to 2 per cent. solution of carbolic acid, or swabbed out, according to Kaltenbach's direction, with a 5 per cent. solution of carbolic acid, or 1 per cent. of lysol, or with chlorine water. Next the sutures for the uterine incision are introduced, and here is the great merit of Sänger's improvement in the Cæsarean operation, an improvement which has given the operation in recent years a marvellous success, conjoining with deep, superficial sutures, carefully bringing the peritoneal margins in close contact, and protecting against hemorrhage. Sänger and others who employ these sutures use fine silk, much smaller than that employed for the deep stitches. The deep sutures are made down to, but do not include the uterine mucous membrane; there may be five, six, or seven of these, and then probably twice as many superficial sutures: the material for the sutures is of antiseptic silk.[1] After the introduction of the stitches the constriction of the uterus, whether by fingers or tube, is discontinued. If hemorrhage from the wound follows, additional stitches; if from relaxed womb, uterine injections of hot water, ergot hypodermatically, tamponing with iodoform gauze, and should these means fail, supravaginal amputation of the uterus, known as Porro's operation, may be required. But such hemorrhage is exceptional, and supposing it absent, the next step is "the toilet of the peritoneum," thorough washing out the abdominal cavity with water as hot as can be comfortably borne; for this purpose nothing is better than the apparatus previously mentioned. Following the thorough cleans-

[1] Schauta uses silver wire for the deep sutures. Fritsch rejects the double sutures, nor does he avoid in the introduction of sutures the deciduous membrane.

ing of the abdominal cavity is the uniting the abdominal incision with stitches, silkworm-gut being generally used; these are chiefly deep, including the peritoneum, and after they are introduced and tied superficial sutures of catgut are employed at points where the skin gaps. Iodoform is sprinkled upon the line of incision, antiseptic gauze laid next to the abdomen, then cotton batting, and finally a firmly fitting flannel bandage applied. The after-treatment is that of abdominal section in general, and therefore need not be given.

Gastro-hysterectomy, Supra-vaginal Amputation of the Uterus, Porro's Operation. Porro, of Milan, in 1876,[1] having come to the conclusion that the great mortality of gastro-hysterotomy was due to leaving the injured uterus in the abdominal cavity, performed supravaginal amputation after the extraction of the child. The successes were superior to those obtained by the usual Cæsarean operation, but with the improvement in the method of doing the latter, introduced by Sänger, the mortality of the two has been reversed, so that the profession generally prefer gastro-hysterotomy to gastro-hysterectomy in most cases; nevertheless, all admit a limited field for the latter.

Indications for the Operation. Parrish,[2] in his valuable contribution to the subject, states that the operation should be done when, through unwarranted delay, or by reason of unwarranted attempts at delivery, the uterine tissues have been seriously injured, or when the child is putrid, or when the patient is greatly exhausted by incipient or established septicæmia, and when there is extensive fibroid or fibrocystic degeneration of the uterine body. Among the indications given by Winckel are: Pregnancy in a rudimentary horn, the ovary on that side to be also removed, in hernia uteri gravida bicornis inguinalis, if it cannot be reduced, in very extensive adhesions of the vault of the vagina, and in echinococci of the uterine wall and of the pelvic connective tissue, which cannot be removed in any other way and which make the pelvic canal absolutely impassable, and in severe puerperal osteomalacia. Schultze's removal of the uterus seven days after delivery has been mentioned, as well as the indication given by uterine hemorrhage after gastro-hysterotomy.

Supravaginal amputation of the uterus is also indicated after abdominal section for ruptured uterus if the hemorrhage cannot be otherwise arrested.

Porro's operation is, strictly speaking, partial hysterectomy. Bischoff, in 1879, removed the entire uterus. According to Auvard, 1890, Bischoff's operation has been done three times, always with a fatal result to the mother.

Method of Operating: Müller's Modification. The preparation and the abdominal section are the same as for gastro-hysterotomy; so, too, the incision of the uterus and the extraction of the child, as directed by Porro. Müller, however, modified the operation by having the abdominal incision so large as to permit eversion of the body of the uterus, and encircling the lower portion with a rubber tube,

[1] This operation, however, was first done by Dr. H. R. Storer in 1868.
[2] First edition of this work.

and then the uterus is rapidly opened and the child extracted. No matter which method is employed, the placenta and membranes are left in the uterus. After cleansing the abdomen the upper portion of the abdominal incision is closed with sutures. Next the uterus is amputated with scissors, knife, or by the thermo-cautery about three-fourths of an inch above the constricting rubber. If the external treatment of the pedicle is employed, and this is the general rule with operators, the stump is encircled with a wire connected with a constrictor, Cintrat's, Tait's, or other, the wire tightened, the rubber removed, and two long, thick needles passed through the stump; these transfixion needles hold the stump outside the abdominal cavity after the incision is completely closed. The advantages in using wire is that in case hemorrhage occurs, as may happen from shrinking of the pedicle, a few turns of the screw tighten the wire so that the bleeding is promptly arrested. Mr. Tait refers to the operation as the easiest "in abdominal surgery, and every country practitioner ought always to be ready to perform it. No special instruments are required—nothing but a knife, a piece of rubber drainage-tube, two or three knitting-needles, and a little perchloride of iron." The stump is brushed over with a solution of the perchloride of iron. The transfixion needles are removed in ten to twelve days. In case the intra-peritoneal treatment of the stump is selected, the operator begins by carefully stitching the mucous membrane of the stump with silk sutures; next the muscular tissue is stitched over this, and finally the serous above it. If any bleeding occurs upon removing the rubber tube, additional stitches are taken, or the afferent vessels of the broad ligaments ligated. When all bleeding is stopped the pedicle is dropped in the abdominal cavity.

Gastro-elytrotomy. This operation was first suggested by Jörg, in 1807, attempted by Ritgen in 1821, advocated by Auguste Baudelocque in 1823, twenty years later attempted twice by him, the first attempt a failure, but in the second a dead child delivered and the mother perishing seventy hours afterward, done in Italy in 1857, the child saved but the mother dying, was again brought before the profession by Thomas in 1870. Whatever of fame and success the operation had during the brief period of its limited acceptance is chiefly due to T. Gaillard Thomas. But, as Winckel states, the operation rested on false premises regarding the peritoneum. Its success, too, is inferior even to the operation of Porro. Clark[1] gives the maternal mortality as 54 per cent., and the fœtal as 36 per cent. The special purpose of the operation was to avoid exposing the peritoneal cavity, and it accomplished this by making an opening into the vagina, beginning with an incision upon one side about an inch above Poupart's ligament; the tissues were divided to the peritoneum, and this was separated until the lateral cul-de sac of the vagina was reached; the wound was four and a half to five inches long; a small incision was made into the vagina, and the opening enlarged by tearing; the os was dilated, and child and placenta were removed through the abdomino-vaginal wound.

"The operation has no future." Winckel, in condemning it, hopes that his lines may hasten it once more to a silent burial, and that it may have no resurrection.

Post-mortem Delivery. The Cæsarean operation was originally done in case of women advanced in pregnancy dying undelivered. This was the civil law in Rome[2] dating from the time of Numa Pompilius.

[1] Contribution to à l'Etude de la laparo-elytrotomie, 1887.

[2] In Plutarch's Lives it is stated that Scylla having died, his wife, "Valeria was afterward delivered of a daughter, named Posthuma; for so the Romans call those who are born after the

But the fact that post-mortem delivery by an abdomino-uterine incision was recognized in ancient mythology—as is exhibited by the history of the birth of Bacchus, the god of wine, and that of Æsculapius, the god of medicine—renders it probable that the operation is still older.

The Church, as Hubert remarks, merely reproduced the injunction of the Roman law in the following degree of its Ritual: Si mater prægnans mortua sit, fructus quam primum caute extrahatur.

As has already been indicated, the method of delivery after the mother's death, exclusively recognized in ancient times, and indeed that which has most generally been employed since, was the Cæsarean section. Unfortunately, in some instances in which it has been resorted to the woman was not dead, and more than one operator has fled horror stricken upon finding the manifestations of life when he thought his incisions were made upon a corpse.

Thévenot[1] has earnestly contended for delivery through the natural passage, as successfully accomplished by the Italian school, especially by Rizzoli, and asserts that the post-mortem Cæsarean operation belongs to another age and ought to disappear from our practice. Depaul, in 1861, said, "I cannot too strongly insist, with almost all those who have studied this subject, upon the advantages which extraction of the infant by the natural passage gives. One ought not to hesitate in the application of a bistoury to the cervix and relieving resistance by multiple incisions. There can be thus obtained in a few seconds sufficient dilatation to perform version or to apply the forceps." There have been several successful deliveries effected in this way,[2] but, of course, it is only applicable in normal conditions of the pelvis, and will be most successful when the death of the mother occurs during labor. The method is especially applicable in cases of apparent death, or when there is doubt in regard to the question as to whether life is actually extinct.

If the Cæsarean operation is employed, the same precautions should be used as if it were being done upon the living subject. Only a small minority of children can be thus saved; the successes generally occur only in those cases in which the mother has died suddenly, and when the operation is done within twenty-five minutes after her death.

father's death." It might be justly implied from this that the removal from a dead mother of a living child was unknown among the Romans. Readers of Shakspeare will be reminded in the play of Cymbeline of the words spoken by the apparition of the father of Leonatus Posthumus:

Hath my poor boy done aught but well,
Whose face I never saw?
I died whilst in the womb he stay'd,
Attending Nature's law.

By the way, the mother's words, following those of the apparition, point clearly to a successful Cæsarean operation:

Lucina lent me not her aid,
But took me in my throes;
That from me was Posthumus ript, etc.

[1] De l'Accouchement artificiel par les voies naturelles substitué a l'opération Césarienne post-mortem, Paris, 1878.

[2] Dr. Barton C. Hirst has reported a case in which the post-mortem Cæsarean operation was avoided by dilatation of the os while the woman was dying; the dilatation was accomplished in a few minutes, and a living child extracted. Philadelphia Medical News, May 24, 1890.

According to Auvard, this method of delivery, accouchement forcé pendant l'agonie, was directed by Costa in 1827. He states that unless there is an urgent indication, it is preferable not to trouble the final minutes of the dying by an intervention which can be as well done after life ceases. Nevertheless, in Dr. Hirst's case there does not seem to have been any disturbance of the patient by the intervention. Millot, De l'Obstetrique en Italie, 1882, gives 14 cases, the first in 1858, the last in 1870, of this method of delivery, 5 of the 14 women suffering from pulmonary phthisis. Only 3 of the 14 children were delivered alive.

CHAPTER XIV.

EMBRYOTOMY.

EMBRYOTOMY includes all operations employed to lessen the size of the fœtus, facilitating or rendering possible its transmission through the birth-canal. These operations embrace, therefore, perforation of the cranium and removal of its contents, cephalotripsy, cranioclasm, breaking up the base of the cranium—as by transforation, the method of Hubert, or by the basiotribe of Tarnier, or by the basilyst of Simpson—and the division of the head into sections, or lamination, decollation, evisceration, and spondylotomy.

Embryotomy is one of the oldest obstetric operations, directions for its performance having been given by Hippocrates. All obstetricians recognize it as not only a right, but also a duty in certain circumstances, to perform embryotomy upon the dead fœtus; while some, and the number is steadily increasing, condemn its performance when the child is alive; some, indeed, have had so strong a repugnance to directly sacrificing the life of the child that they have done it indirectly, waiting until it died before resorting to the operation, thereby in no sense evading the responsibility for its death, and at the same time by delay adding to the perils of the mother. The principle of morals upon which most obstetricians rest the right to sacrifice the child for the sake of the mother is a very old one, and has met with general acceptance; that principle, clearly enunciated by Cicero,[1] for example, and sustained in general by moralists of all ages, is that if two lives are in such peril that both cannot be saved, but one will be by the sacrifice of the other, let that life which is of least value to the State, or to society, perish. It is unnecessary to show that the adult woman with her various domestic and social duties, has a life of greater value than that of the unborn child; and, therefore, while the duty of the obstetrician is to save, both when he can, if either is to be sacrificed let it be that of the latter—in other words, if in a given case embryotomy is a less risk to the mother than Cæsarean section, the former should be selected. This is a rule of obstetric ethics which cannot be set aside. Fortunately the brilliant successes recently had by a few operators in Germany render it highly probable that embryotomy upon the living fœtus will soon be restricted to very narrow limits.

Symphyseotomy, too, promises much in lessening the occasion for craniotomy upon the living child. Nevertheless, there are conditions which clearly justify it. For example, in case of hydrocephalus, or in that of a monstrosity, causing an obstacle to delivery, we do not hesitate to sacrifice the life of the child for the safety of the mother. Further, in case of threatened rupture of the uterus, immediate delivery is imperative; and frequently this delivery can be most promptly accomplished by lessening the size of the child.

Winckel admits craniotomy upon the living child, first, if its life is much endangered so that its chances of being saved are improbable, in order to protect the mother, as far as possible, from the dangers of a more difficult operation; and, second, if a relative indication for the Cæsarean section exists—that is, if the child cannot be delivered through the pelvis as it is, and the mother firmly refuses the operation. "The percentage of maternal deaths in the hands of

[1] "Quid, si in una tabula sint due naufragi, hique sapientes, sibine utervis rapiat, an alter cedat alteri? Cedat vero; sed ei, cuius magis intersit vel sua, vel reipublicæ causa, vivere. Quid, si haec paria in utroque? Nullum erit certamen, sed, quasi sorte aut micando victus, alteri cedat alter." (Cicero de Officiis, Book III., xxiii. Pereya's ed.)

skilful operators is reckoned at 0 after perforation and as at least 8.4 per cent. after the Cæsarean section. The former is entirely free from danger, and the latter, especially in the hands of an inexperienced man, can only be designated as quite dangerous; therefore, perforation of the living child will be considered justifiable in many cases."[1] Winckel also states that craniotomy must not be performed on a living child without the mother's consent.

Auvard says: "If the life of the child were as valuable as that of the mother there could be no hesitation in giving the preference to hysterotomy; but the appreciations are different in this regard, and while the Cæsareans say that the life of a perfectly developed infant is more precious than that of a woman unfit for procreation, the anti-Cæsareans reply that the life of the newborn, surrounded by so many dangers, cannot be regarded as equal to that of a healthy woman."

"If it were your wife or your child, what would you do?" The Cæsareans are embarrassed, for if obedient to their principles, they will be considered bad husbands. On the other hand, the anti-Cæsareans will seem to be bad fathers, for they do not hesitate to sacrifice their child. In this question, which ought to be purely scientific, it is better that sentiment should not enter, or it becomes insoluble. However, in accepting that the life of the mother has a greater value than that of the child awaiting birth, we may attempt to indicate the better choice between the operations, though confessing that it is arbitrary and admits of discussion."

Cancer of the uterus or of the vagina suggests hysterotomy rather than embryotomy, is generally held by obstetric authorities. Again, if the pelvic contractions be such that a living child may be born were premature labor induced, and the pregnancy is at term, embryotomy is selected with the hope that a subsequent pregnancy may occur and be prematurely terminated, is an opinion expressed by Auvard. The more difficult cases for decision are those in which it is impossible, on account of the pelvic deformity, for a woman to give birth to a living child, though premature labor be induced, and embryotomy can be done with little risk to the woman's life. Here Auvard, Winckel, and, indeed, the majority of obstetricians, would leave the decision to the woman herself.

I think most practitioners will coincide with the opinion of Naegele, in saying that if the indication is only relative and the mother, in sound mind and after mature reflection, positively refuses to submit to the Cæsarean operation, it would be an unjustifiable cruelty to compel her to undergo it.

Dr. Jaggard has given, in the *American Journal of Obstetrics*, the following as the expression of Carl Braun's views in regard to the relative indication for the Cæsarean operation:

Cæsarean section on the living woman, for the preservation of the living fœtus in pelvic deformity—in which the child, dead and diminished in volume, can be extracted through the pelvic canal, and the health of the mother can with probability be preserved by the perforation of the child's head—is not permissible under the following conditions:

a. When the parturient woman, in full consciousness and without any direct coercion, declines Cæsarean section.

b. When the parturient woman is rendered unconscious by disease (eclampsia, meningitis, apoplexy, etc.), by medicines (chloroform, ether), by poisons, or intoxicating drinks.

c. When the child's life has been imperilled by uterine contractions, attempts at version, or the forceps, or when the child is deformed or not viable.

For a series of years not a single parturient woman in the Vienna Lying-in Hospital has determined to submit to Cæsarean section upon the ground of the relative indication.

INDICATIONS. Those relating to the pelvis or caused by cancer of the uterus or vagina have already been stated. The operation has also

[1] Runge gives the maternal mortality in general at 18 to 20 per cent.

been done in hypertrophic elongation of the cervix and in cicatricial contraction of the vagina. Excessive size of the fœtus, and a neglected shoulder presentation in which version is impossible or would be attended with imminent danger of rupture of the uterus, are indications. It may be necessary in a brow or parietal presentation, or in that of the face when anterior rotation is impossible.

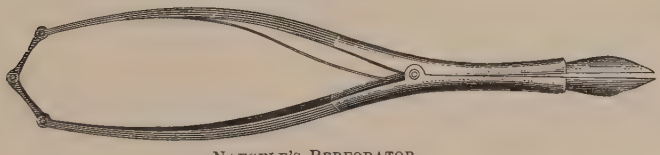
Craniotomy. Most frequently reduction of the size of the fœtal head is necessary, and the first step is perforation. So, too, perforation precedes the application of the cephalotribe, or its most recent modification, the basiotribe, or of the cranioclast.

Perforation. Reduction of the size of the head, whether this comes first or last, is necessary. Supposing the head presents, the first step is perforation of the cranium. In order that this may be done readily and safely, the head must be held by an assistant, who presses upon it through the abdominal wall with his hand during perforation.

Fig. 255.

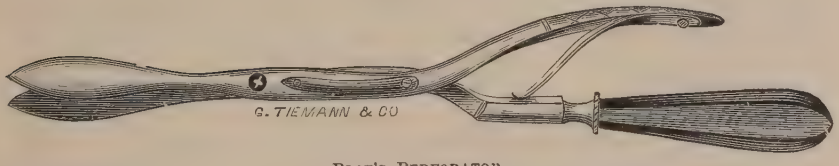
Smellie's Scissors.

Fig. 256.



Naegele's Perforator.

Fig. 257.



Blot's Perforator.

Fig. 258.

Martin's Trephine.

Carus was the first to apply forceps in order to secure this immobility, a practice which many have imitated. The instrument selected for perforation may be Smellie's scissors, or Naegele's perforator, or Blot's, or a trephine, Martin's, for example.

Winckel states that he always prefers scissors if a fontanelle or suture can be reached, but if it cannot be, and the cranial bones are very hard, he uses a trephine.

Fritsch condemns all trephine perforators—those of Kiwisch-Leissnig and of Braun among them—because of the difficulty in thoroughly cleaning them; for in order that this can be properly done, they must be returned to the instrument-maker each time after they are used. If the operator has Tarnier's basiotribe, or the similar, and probably better, instrument of Auvard, he will need neither scissors nor trephine.

FIG. 259.

SIMPSON'S BASILYST.

The patient occupies the position advised for the application of the forceps; anæsthesia is usually unnecessary. The operator, after the vagina has been washed out with an antiseptic solution, and the hands and instruments have been made aseptic, introduces two fingers of the left hand into the vagina and brings their tips in contact with the fœtal head; the scissors, or perforator, now held with the right hand, has the blades guided along the palmar surface of the fingers in the vagina until their points are brought in contact with the fœtal skull and placed perpendicularly to the bony surface. It is better to perforate bone than to enter through a suture or a fontanelle, for then the opening is more likely to remain patent instead of being closed by the approximation of the fœtal bones under compression. The next step is, while carefully guarding the instrument from slipping, by a boring movement to make its points penetrate through the bone; when this is accomplished the blades are caused to enter as far as the shoulders of the instrument, then opened so as to divide the bone, and after this closed, given a quarter rotation and again opened, so that an incision perpendicular to the first one is made. The next step is to thrust the scissors deeply in the cranial cavity, move the blades in different directions, so as thoroughly to break up the brain substance, including the medulla oblongata—if, by misfortune, it has been necessary to operate upon the living fœtus—for more than once after a craniotomy, when this precaution was not taken, the child has been born alive and even lived for some days in a horribly mutilated condition, greatly to the distress of the family, if not to the disgrace of the obstetrician.

In case a trephine be used for perforation, the instrument must be introduced and brought to press firmly upon the bony part selected, and held in position with the fingers of the left hand, while the right hand is used to give slow rotary movements to the crown after the screw has penetrated the bone.

After perforation the nozzle of a syringe is introduced into the artificial opening and a stream of warm carbolized or creolin water thrown in, so that the brain substance is washed out. The delivery may now occur spontaneously, or the fœtus may be extracted with the crotchet, or a cranioclast may be used, an instrument which, if carefully used, does not deserve the reproaches that have been cast upon it (Figs. 260, 261, and 262).

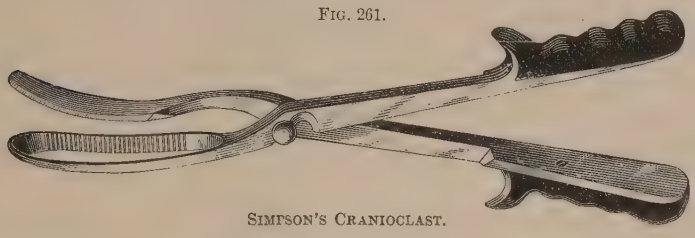
Of course, if the practitioner has at hand a cranioclast or a cephalotribe, delivery can generally be more promptly accomplished with either than with the crotchet; but with most practitioners the last is more available than the other instruments. In order to prevent the injury that may be done the mother's soft

FIG. 260.

CROTCHET.

parts by the crotchet slipping a guarded instrument has been invented, but it will prove a most inefficient one for traction; it is guarded alike from doing any good as well as any harm. The hook-like end of the instrument is introduced into

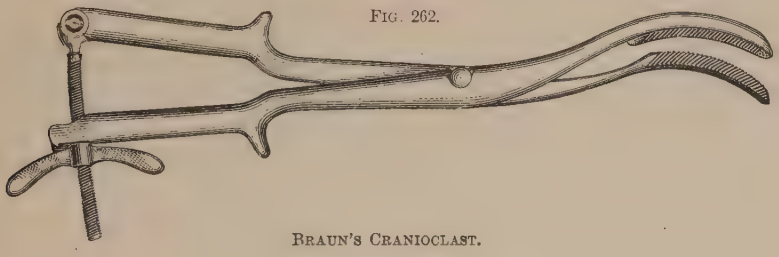
FIG. 261.



SIMPSON'S CRANIOCLAST.

the fœtal skull, a firm hold secured, and two fingers placed upon the outside of the head, directly opposite the point at which the instrument has caught, so as to prevent its slipping, or if it does, to guard the vagina from harm; if slipping

FIG. 262.



BRAUN'S CRANIOCLAST.

occur, another part of the fœtal head should be sought and a firmer hold secured. Care must be taken not to tear the fœtal scalp, for this protects the mother's parts from being injured by the otherwise exposed edges of bones or of their fragments.

CRANIOCLASM. In most cases the cranioclast is one of the most efficient instruments not only for breaking up the bones of the skull, but also for extraction. The cranioclast is the invention of the late Sir James Simpson. It is composed of two separate blades, fastened by a button joint, one for introduction within, the other to be placed without the skull; when applied and locked the concavity of the external blade fits upon a convexity of the internal one, a portion of the fœtal skull being firmly included between the two. The cranioclast as now made includes a transverse arm connecting the ends of the handles; this arm

has a screw, and a nut, which, after its application, causes the handles to be brought closer together and makes them immovable, so that a firmer fixed grasp upon the fœtal head is secured.

Cephalotripsy. The cephalotribe, devised by the younger Baudelocque (nephew of the great obstetrician) in 1829, consists of two strong forceps branches, in some instruments straight, but in others having the pelvic curvature of forceps; the blades are very narrow, so as to admit of their introduction into a contracted pelvis, and in most instruments solid, but in Bailly's and in some others fenestrated—a single fenestra in each blade in some, but in others, as Tarnier's, three. The instrument is provided with a transverse bar made as a screw and applied to the ends of the handles. The blades are applied to the sides of the fœtal head, which is then compressed by means of the powerful screw at the handles. Perforation ought always to precede the application of the cephalotribe, but it is unnecessary to wash out the cranial cavity, for the strong pressure to which the head is subjected will force out the contents. In most of cases in which the cephalotribe is necessary there is such narrowing of the inlet that the head is in a transverse direction, and the blades of the instrument seize it in the direction of the suboccipito-frontal diameter. But as it is important to break up the base of the cranium, Wasseige[1] advises when one cannot seize the head by the biparietal diameter, to diagonalize it, as far as possible, before the application of the instrument; "that is, we bring the head anterior and then apply the instrument in the oblique pelvic diameters; these applications can be made where the pelvic narrowing is between 5.5 centimetres and 7.5 centimetres —that is, between 2.1 and 2.7 inches, while below the former oblique applications are impossible."

After the crushing, which must be done slowly, one or two fingers should be introduced to ascertain that the part of the head which has been widened in opposition to that which narrowed lies in the longest pelvic diameter, and that no spiculæ of bone are exposed which will tear the mother's soft parts in the extraction of the head; and if these be found, the fingers are kept in the vagina to protect it from injury during the operation. To bring the long diameter of the fœtal head in correspondence with that of the pelvis, a quarter rotation of the instrument, still, of course, retaining the head in the grasp of the instrument, is made, and then traction exerted as in forceps delivery. In some instances before the latter can be effected, it is necessary to remove the cephalotribe, especially if the instrument slip, and apply it in another direction so as completely to crush the skull. If extraction remains impossible after repeated crushings, some operators advise waiting a few hours until uterine contractions have so moulded the head that its transmission becomes possible.

It may be added that the cephalotribe is an instrument which has been almost superseded by the cranioclast, many obstetricians rejecting it.

Lamination. This name is given to the process of dividing the head into two or more segments. The first method is that of Van Huevel; in 1842 he devised his forceps-saw, and successfully applied it in 1844. The fundamental idea is the section of the cranium by a saw acting from below above between the blades of a forceps, and dividing the head, more especially the base of the cranium, into two portions. Other varieties of the forceps-saw have since been invented.

The expense of the instrument and its somewhat complicated character will prevent its general use in craniotomy. Barnes says that it is difficult or impossible to apply when the conjugate is reduced to 2 inches, or even to 2.5; Wasseige, however, states that the instrument can be used when the conjugate is only 30 millimetres, 2.1 inches.

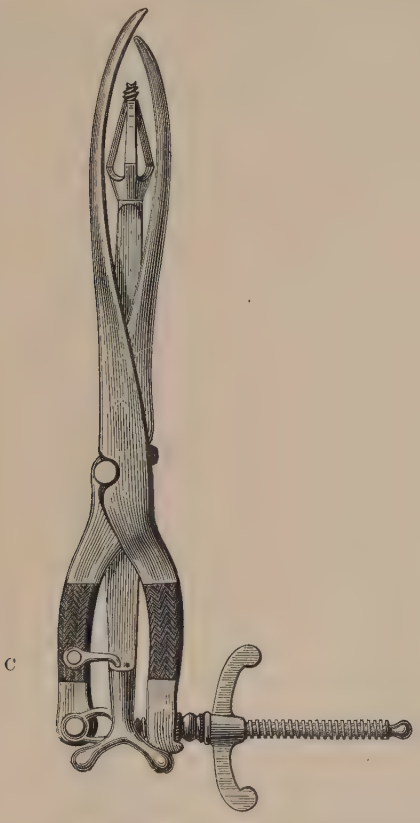
Barnes, 1869, showed that section of the fœtal head could be made with the wire écraseur, and this simple method is to be preferred.

Breaking the Base of the Fœtal Head. Various instruments have been proposed for this purpose, but only three will be mentioned: the *transforateur* of Hubert, devised in 1860; the basilyst of Simpson, and the basiotribe of Tarnier. The first consists of a firm rod of steel, terminating at one end in a

[1] Op. cit.

transverse handle, and at the other in a pear-shaped screw with a sharp, stiletto-like point, and of a protecting branch which is attached to the rod; it is shaped like the forceps blade, and has a conical opening in its lower end to receive the point of the perforator. This point, covered with wax, or concealed by the finger of a rubber glove, when introduced, is made to penetrate the cranial vault, either through a bone, a suture, or a fontanelle, and then by movements of rotation the opening is gradually enlarged until the entire pear-shaped portion enters; the next step is by free movements of the instrument to break up the cerebral tissue. After this the point is guided to the occipital foramen, and when

FIG. 263.



TARNIER'S BASIOTRIBE; THE PARTS UNITED.

this is found, the former should be directed toward the chin, and when at a distance of 4 or 5 centimetres, 1.5 to 1.9 inches, in front of the foramen the *sella turcica* is reached, which is then perforated by means of rotary movements, and the protecting branch is applied just opposite upon the fœtal head. The basilyst of Alexander R Simpson, which Wasseige states is only a modification of the *diatripteur* of Didot, was presented to the Edinburgh Obstetrical Society, January, 1880, and an improvement of it January, 1883, when the inventor reported a case in which basilysis was successfully employed in dystocia from hypertrophic elongation of the cervix (Fig. 257).

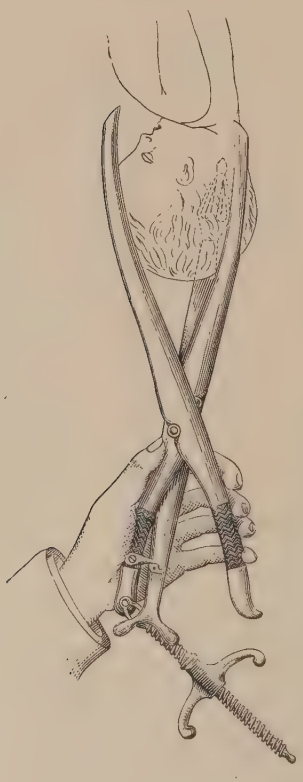
The instrument has also been successfully used directly to break up the base of the skull in narrowing of the pelvis; in one instance the transverse diameter

of the base was reduced from 3 to 2 inches. Whether, as Simpson has said, basylisis is the operation of the future or not, he certainly has invented a simple and ingenious instrument for accomplishing it.

The basiotribe[1] of Tarnier was presented to the Paris Academy of Medicine, December, 1883. It combines an excellent perforator of the cranial vault and a cranioclast; it does not break the base of the head, as do the instruments of Hubert and Simpson, by penetrating it, but by crushing. Fig. 263 represents the several parts of which the basiotribe is composed, united.

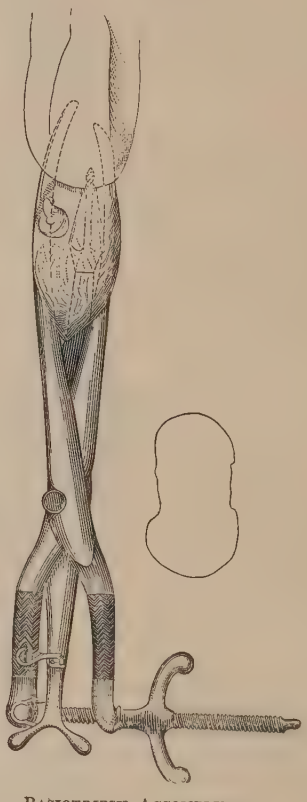
In operating, the perforator is made to penetrate the cranial vault, after which the left or short blade of the instrument is introduced and fastened by the catch, C, and then the right or long blade; the screw is then fastened to the end of the handles, and turned until sufficient crushing is effected.

FIG. 264.



APPLICATION OF TARNIER'S BASIOTRIBE.

FIG. 265.



BASIOTRIPSY ACCOMPLISHED.

PERFORATION IN PRESENTATION OF THE FACE. This is more difficult than perforation in vertex presentation; it may be done through

[1] It has since been usefully modified by Barr.

the palatine vault, through one of the orbits, or through the frontal bone, the last being preferred.

Perforation in Head-last Labor. An assistant holds the body of the child to one side, and the operator perforates the head at one of the posterior lateral fontanelles. Chailly advised that the opening be made through the palatine vault, condemning acting either upon the forehead or the occiput, because the point of the perforating scissors could not be directed perpendicularly, but must be placed obliquely to either bony surface, and hence were liable to slip, injuring the mother.

In concluding the subject of craniotomy it is to be remarked that the student should not think it a very simple and easy operation that can be quickly performed and delivery promptly effected. This is true in some cases only, but, in many, difficulties attend almost every step in the process, and in rare cases the delivery may not be accomplished for hours. Therefore the operation is not to be undertaken unless the proof be clear that it furnishes the best chance for the mother, and, on the other hand, not delayed until her powers are so exhausted that she is liable to perish before or after its accomplishment.

Decollation, Derotomy, or Decapitation. In case of shoulder presentation, when turning is impossible from the condition of the uterus, or from the presenting part being wedged in the pelvis, it is necessary in most cases to divide the neck. This operation may be done with the scissors of Dubois, with the decapitation hook of Braun, or simply by means of a piece of strong twine[1] thrown around the neck, and used as a saw, to-and-fro motion given it, the maternal parts being protected from injury by the ends of the string being passed through a tubular speculum, and in two or three minutes the neck will be divided. If the scissors of Dubois is used, or the hook of Braun, the first step is to pull down the presenting shoulder by traction on the corresponding arm; the next step is, with thumb and finger of left hand to seize the neck so that the hook may be passed over it, or, using scissors, hold it until the division is made; it may also be held by the ordinary blunt hook instead of by the fingers. If Braun's hook is used, after placing it over the neck, strong traction with partial movements of rotation is employed, and the neck is quickly severed. The body is then readily extracted in most cases by pulling upon one of the arms; the head is withdrawn by traction with two fingers in the mouth, or by the forceps; in some instances it may be necessary to lessen its size.

Melotomy. It may happen that an upper or lower limb is in the vagina,[2] and so greatly swelled that manipulations upon the body of the child are impossible in consequence of the obstruction; the child being dead, the member is amputated by the scissors of Dubois.

Spondylotomy. This is the name given to division of the vertebral column at some other point than the neck. It may be done with the scissors of Dubois.

[1] This method of decollation has been repeatedly done in practice, more especially in France; I have been in the habit for some years of illustrating it before my class at Jefferson Medical College, using a full-grown fœtus and Bodin's obstetric manikin.

[2] Lomer, op. cit., tells of an obstetrician who called to a case of labor in which he found the shoulder wedged in the pelvis, the arm prolapsed, and believing the child dead, performed exarticulation of the arm; the child was born living, and continuing to live, when he was twenty-one years old sought damages from the operator!

Evisceration. This is chiefly resorted to in those cases in which an impacted shoulder presentation prevents access to the neck. Again, the scissors of Dubois, or a similar instrument, will be the most useful in opening the chest; after the contents are in part removed, an effort is made to deliver the fœtus, of course doubled upon itself, by the crotchet or the blunt hook.

After embryotomy not only the external sexual organs and the vagina, but also the uterine cavity must be disinfected. For this purpose a solution of lysol 1 to 1½ per cent. may be employed; a corrosive sublimate solution will not be used, at least for irrigating the uterus. So, too, the utmost care must be taken subsequently to guard against infection.

Winckel, in 3500 labors, performed embryotomy in 16, or only 0.46 per cent., and two mothers died; the mortality, therefore, was 12.5 per cent. Zeitlmann[1] records 121 cases of craniotomy at Dresden, 1883–1892, with 15 deaths, 12 of these occurring outside the *Klinik;* more than one-half of the women who had been operated upon were free from fever, and with three-fourths the lying-in was of normal duration.

It is of interest to state that craniotomy was done upon the living child in 14 cases, in 5 on account of threatened uterine rupture, 4 on account of eclampsia, and in 1 in consequence of uterine tympanites, and in the rest for other dangers of the mother.

[1] Jahresbericht über die Fortschritte auf dem Gebiete der Geburtshilfe und Gynäkologie, 1894.

SECTION III.

THE PATHOLOGY OF THE PUERPERAL STATE.

CHAPTER XV.

INTRODUCTORY. The diseases here considered will be chiefly those connected with the puerperal condition, only a few of such as accidentally occur being referred to; there will be presented, too, the subject of sudden death in or after labor, and also some of the diseases of the newborn, in addition to those treated on pages 353, 354, 358.

DISEASES OF THE BREAST. The breast is a compound organ, one part being for the secretion of milk and the other for its discharge. The tissues covering the gland, and interposed between its constituent parts, and connecting it with the chest may be called adventitious.

DISEASES OF THE NIPPLE. Fissures and ulcers of the nipple are not infrequent. They occur oftener in primiparæ and in blondes. Among the causes are want of proper care in the latter part of pregnancy, failure of cleanliness, difficult extraction of the milk, either from the form of the nipple or the weakness of the child, so that each nursing is prolonged, and the skin of the nipple softened so that the epidermis is in places detached; or, again, the robust child, by its violent sucking, may cause mechanical injury—it has been said that some infants have "murderous mouths"—and later in lactation the infant may bite or bruise the nipple. From an ulcerated and fissured surface blood may escape when the infant nurses, and be swallowed with the milk, so that in case blood appears in the stools or in the vomited matter of the child, this possible source should be considered. In addition to the suffering the mother has when the child is put to the breast, the possible suspension of lactation, temporary or permanent, and the mammary inflammation which may result from disease germs entering through these fissures or ulcers, their prevention, and, if they do occur, their prompt cure, are most important.

The prophylaxis in pregnancy, believed by the writer most useful, has been given on page 221. To this may be added, that Ahlfeld directs the daily application to the nipple in the last weeks of pregnancy of equal parts of tincture of galls and water, or one of the former to two of the latter.

So, too, on pages 349 and 350 the prophylaxis after lactation begins, and some of the methods of treating diseased nipples are presented. Kaltenbach advised, if fissure of the nipples appeared, disinfecting them with a

two and one-half per cent. solution of carbolic acid, and covering them with sterilized gauze; he also recommended, if nursing were painful, the use of the glass nipple-shield, and commended the double-aspirating shield of Auvard.

Fig. 266.

Auvard's Double-aspirating Nipple-shield.

The shorter tube is used by the infant, and the longer by the mother or nurse; suction on the part of either of the latter facilitates the escape of the milk, so that but little effort on the part of the former is necessary, and the time of nursing is shortened. Ahlfeld commends the application of ice in the intervals between nursing. In some cases the suspension of nursing from the affected nipple for several days will be necessary in order that it may heal.

Mastitis. This is, after fissures of the nipple, the most frequent of puerperal mammary diseases; it is caused by bacteria. About 6 per cent. of nursing women suffer from it. Three varieties of the disease are recognized. 1. Simple phlegmon, or inflammation of the connective tissue, the origin being in the infection from fissures or ulcers. 2. Inflammation of the glandular portion, the infecting agents entering through the milk ducts. 3. In exceptional cases the breasts are the seat of metastatic abscesses arising in the course of general infection.

In very rare instances the first form of inflammation may involve the connective tissue posterior to the gland, and result in the formation of a retro-mammary abscess.

Inflammation of the connective tissue, called also interstitial mastitis, is much the most frequent form of the disease. The streptococcus pyogenes is the cause, more seldom the staphylococcus, of this form of inflammation, while the latter is present in parenchymatous inflammation.

So far as the entrance of infectious organisms through the milk-ducts is concerned, several observers have found them in the first drops of milk, and it is not easy to understand why they are in the vast majority of cases harmless and in a few most mischievous.

The majority of cases of mastitis begin the second week after labor;

a chill occurs and is followed by fever; if the fever continues longer than two days, according to Olshausen, suppuration may be expected. Krönig has recently stated[1] that in 20 per cent. of cases of fever in women after labor inflammation of the nipple and of the gland is the cause.

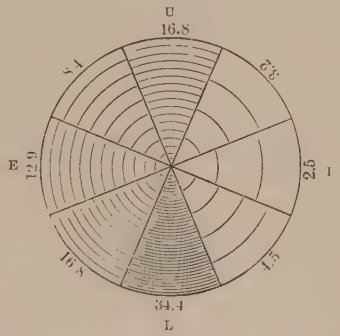
The retention of milk in the breast is not the cause of inflammation, as popularly believed, and therefore the continued efforts to draw the milk out, efforts that frequently are by no means gentle, have not the supposed benefit given them. The view generally accepted by obstetric authorities is that milk stasis is not the cause of mastitis, or, epitomizing the truth, one might say *milk does not make matter*.

It is to be noted that interstitial inflammation may extend to the glandular structure, and so the latter may also involve the connective tissue.

Kehrer[2] states in reference to the relative frequency of inflammation of the breasts, the statistics of Hennig, McClintock, Winckel, and Bryant show that in 598 cases the right breast was affected in 290, or 48.54 per cent.; the left breast in 225, or 37.6 per cent., and both breasts in 83, or 13.8 per cent.

He also gives the following figure, showing the relative frequency with which different lobules are affected:

FIG. 267.



ILLUSTRATING PARTS OF BREAST INFLAMED. RELATIVE FREQUENCY.

U, upper part of breast; L, lower; E, external, and I, internal.

The breast is represented as divided into octants, and there can be read on the outside of the external circle the per cent. of each of these parts that is inflamed.

Treatment. If mastitis occurs, the child should not be permitted to nurse from the affected breast, though it continues to use the other. The breast is supported by a suitable bandage. Winckel advises the application of compresses of lead-water day and night; a saline may be given, and the patient restrict the quantity of liquid taken. Dr. Bartholow recommends enveloping the breast in lint wet with a solution of atropine in rose-water, four grains to the ounce; he adds to the

[1] Monatsschrift für Geburtshülfe und Gynaekologie, June, 1895.
[2] Müller's Handbuch, Band iii.

advice the caution that as systemic effects may be produced by such an application, the removal of it should the pupils dilate and the mouth become dry.

Dr. Hiram Corson[1] strongly advocated treating mammary inflammation by applications of ice, stating that during twenty-seven years in which he has employed it he has failed in no instance to disperse the inflammation, if suppuration had not already occurred, and at the same time brought comfort to the patient. He stated: "There is no better way to apply the ice than to put it into a bladder with just enough water to float it, or just to form a water cushion, that will fit the inflamed part nicely. It is not necessary to put two thicknesses of muslin between the bladder and the breast; it is not too cold without any, but a single thickness is useful to keep the bladder in place more readily." Now a rubber bag would be used rather than the bladder advised by Dr. Corson.

Both Kaltenbach and Ahlfeld recommend the ice treatment of mastitis. This is certainly a most important testimony to the value of Dr. Corson's plan.

Dr. P. A. Harris[2] advises treating mastitis by bandaging and rest. The plan he pursues is thus stated: "Having discovered the existence of an inflammatory movement in the breast, of any grade of severity, or at any stage of advancement, short of the formation of an abscess, I should at once interdict nursing, friction, pumping, the application of fomentations, in fact, every local measure excepting such as are calculated to secure complete rest for the gland; rest from passive motion, rest from secretion, and rest from pain. All these conditions can, in a great degree, be immediately secured for the patient. Procure at once a roll of soft cotton-wool, cotton batting, a plain roller-bandage at least twenty yards long and two or two and a quarter inches wide; also eighteen large safety pins. The breast is first covered with a layer of cotton-wool, and the bandage so applied as to lift up and compress the affected organ. The patient should be seen daily, and the bandage reapplied until the crisis has passed; this time varying from one to several days."

If suppuration occurs, free opening of the abscess and drainage, antiseptics being employed. The incision must be made in a radiating direction, so as to avoid cutting one or more of the milk-ducts, an accident which might happen were it transverse.

Many years since I first tried, with very satisfactory results, the method of treating mammary abscesses recommended by Dr. Foster. It was referred to by the late Dr. Gross in the second edition of his *Surgery*, 1862, as having been advised "within the last few years." While especially applicable to neglected mammary abscesses in which the pus has burrowed, and sinuses been formed, it may be used successfully in others in which the closure of the abscess cavity delays. It consists in the application to the breast of a large, compressed sponge; of course, the sponge must be thoroughly cleansed and dried; next it is compressed by means of a heavy weight, or in a book-press, and then applied to the breast; it must be large enough to cover it completely, only one or two thicknesses of patent lint placed next the skin, and the sponge secured in place by a firmly applied bandage. Next, the sponge is wet with tepid water through the bandage, and consequently swells, producing uniform compression, so that abscess contents are squeezed out and abscess walls brought in contact. The sponge is changed once in twenty-four hours.

[1] American Journal of Obstetrics, 1881. [2] Ibid., 1885.

Of course, using this method to-day, the sponge would be made completely aseptic, the water used for applying through the bandage to it would contain an antiseptic, and probably the lint would be replaced by antiseptic gauze.

MALARIAL FEVER. This disease may occur in the puerperal period, but it is not frequent. The subjects have, as a rule, had attacks of intermittent, or remittent, shortly before or during pregnancy. Moreover, they present the history of exposure. It is possible that labor with its exhaustion may cause manifestation of the poison that has been lying dormant in the system It is very important that the obstetrician should not make a mistake, attributing to malaria one of the forms of puerperal infection, thereby losing precious time and lulling himself and the patient in false belief of no danger. Malarial attacks are regularly and distinctly intermittent or remittent. The malarial tongue, first described by Osborn, in 1851,[1] and again in 1869,[2] may help in the diagnosis.

"It will be noticed that the middle of the tongue is heavily coated with dirty fur, which thins off toward the point, where the color of the papillæ can be seen pressing through the attenuated coating, whilst on the sides of the fur there are clean, smooth, depressed margins, having a bright red color. The sides or edges of the tongue are flattened, pinkish, and traversed by sharp lines, creating the impression to the eye of the observer that the parts are crenated, striated, corrugated, puckered, or crimpled—either term having a shade of appropriateness—but which, upon close inspection, will be found situated in the substance of the tongue, leaving the mucous membrane even and smooth to both sight and touch." "The transverse lines are too numerous and near to each other to attribute them to pressure by the teeth."

Finally, the promptness with which quinine arrests the disease confirms the diagnosis: *cura ostendit morbum.*

It seem to me probable that in some cases at least, the disease called *Weid*,[3] incorrectly *Weed*, was really intermittent malarial fever; this opinion rests upon the description of the disease and upon its successful treatment by antiperiodics.

SCARLATINA. This disease, though not frequent in the lying-in, is probably oftener observed than in pregnancy, and a prolonged period of incubation has been by some thought to explain the fact.

Before the use of antiseptics scarlet fever in puerperality was very fatal, but now the great majority recover; Meyer, for example, in the Copenhagen Maternity, had twenty-one cases with only three deaths. Nevertheless it is probable that scarlet fever, more than any other of the exanthematous diseases, creates a liability to septic infection.

1 Western Journal of Medicine and Surgery, August, 1851.

2 Transactions of the American Medical Association, vol. xx.

3 An American obstetrician a few years since, referring to the word "weed," states, "The dictionaries of the English language I have examined do not contain the word in the sense of a disease." American System of Obstetrics, vol. ii.

Ephemeral Fever, or Weid, has been described by several obstetric writers; for example, Burns, Ramsbotham, and Churchill.

"Weid, a kind of fever to which women in childbed, or nurses, are subject. German *weide*, or *weite*, corresponds to French *accablé*, as signifying that one is oppressed with disease." Jamieson's Etymological Dictionary of the Scottish Language. Edinburgh, 1818.

In Ogilvie's dictionary the following definition is given: "A general name for any sudden illness from cold or relapse, usually accompanied by febrile symptoms, taken by females after confinement or during nursing."

Ramsbotham remarks that Scott, in his "Bride of Lammermoor," makes one of the women speak of a child as having the "weid;" so that it seems to be applied to children as well as puerperal women.

Antisepsis, isolation, milk diet, in anticipation of possible renal complication, and, if the temperature be high, the cold bath constitute the most generally accepted treatment. For intestinal antisepsis beta-naphthol has been recommended[1] by Tournery and Durand.

Erysipelas. If erysipelas originates in the face or upper part of the body in the puerpera, it frequently runs its course without danger and without interference with normal involution of the sexual organs. In some cases the disease has begun in a fissure or other injury of the nipple. In five-sevenths of the cases, however, the disease starts from the external genital organs, and the nates, according to Winckel. So, too, he states that primiparæ are more liable to erysipelas than multiparæ, three or four of the former to one of the latter. He teaches that the poison of erysipelas may cause one of the grave forms of puerperal fever.

Kaltenbach made the statement that in general one was inclined, both by clinical as well as bacteriological investigations, to believe that the streptococcus erysipelatis and the streptococcus pyogenes are identical.

Bumm (*Histological Researches upon Endometritis*), after referring to the fact that infectious germs proceeding from the endometrium, following the fine lymphatics between the tissue elements, penetrate the uterine wall, and through this finally reach the peritoneum, causing a mortal peritonitis, adds: "It cannot be doubted that this mode of propagation corresponds to that which is observed in erysipelas of the skin, and I am convinced, by these histological demonstrations, that the denomination, internal erysipelas, proposed by Winckel, is justified by this and similar cases, although the distinction between the streptococcus of erysipelas and the streptococcus pyogenes is to-day no longer available."

In fourteen fatal cases of puerperal erysipelas observed by Winckel the causes of death, with the exception of one in which death resulted from meningitis, were colpitis, endometritis, metro-lymphangitis, parametritis, pleuritis, and pneumonia.

In regard to the treatment of puerperal erysipelas, it will not differ from that required by the disease under other conditions. It is important that the infant be cared for by some one else than the nurse having charge of the mother, and that it be taken to another room, lest it should become infected, the infection usually appearing first at the navel.

Puerperal Tetanus. This may occur after abortion, or after labor at term, but it is a rare disease. Sir James Y. Simpson, in 1854, collected 24 cases, and Vinay, in 1891, 106—47 following abortion and 61 labor. As showing the contagious character of tetanus, the case reported by Ammon, of Munich, is important: He had treated a laborer suffering with traumatic tetanus in consequence of a wound of the hand; the day after his death Ammon attended a case of labor, and artificial removal of the placenta was necessary; tetanus appeared the ninth day, and was fatal in five days. Henricius, quoted by Vinay, states that a midwife, making a vaginal examination of a recently delivered woman, just after she had dressed the umbilical wound of an infant suffering with trismus, communicated tetanus to her.

[1] La Rougeole et la Scarlatina dans la Grossesse et les suites de couches. Paris, 1891.

In 52 of Vinay's cases there was some obstetrical intervention, the chief being the artificial removal of the placenta and the application of a tampon. As it has occurred after ovariotomy,[1] in 1877 I collected 13 cases, one of them my own, it has also followed gastro-hysterotomy and gastro-hysterectomy.

The disease is more frequent in tropical countries. Wallace[2] saw at Calcutta in ten years 23 cases, and Pedley[3] states that it is a comparatively frequent cause of death in childbed among the Burmese. Probably want of cleanliness is a more important factor than climate in the production of the disease.

The essential cause is a bacillus discovered by Nicolaier in 1885, and which is found in the soil, especially in that containing dung of the horse, as well as that of other herbivora.

In 44 cases in which the advent of the disease was recorded the time varied from the first to the sixteenth day after delivery. (Vinay.)

Irvin,[4] of Louisville, Ky., has reported a case of tetanus occurring the eleventh day after delivery at term that recovered under supporting treatment, half-grain doses of morphine, *pro re nata*, and chloral in sufficient quantity to procure sleep. Mosher[5] has recently published a fatal case following abortion. While revising these pages I had a letter from Drs. Hopkins, father and son, of Milton, Del., narrating a fatal case of tetanus under their charge June, 1895. The patient was attended by a midwife, the labor natural, and convalescence apparently proceeded normally; an anomaly was the absence of lochial flow after the first day. Tetanus appeared on the seventh day after labor, and death occurred on the ninth. At no time was there a chill, and the patient had no offensive flow and no fever. The treatment was morphine, chloral, and chloroform inhalation.

The mortality of the disease is given by Vinay as 88.8 per cent.

But little can be said as to the treatment. Prevention is more hopeful than cure. The vitality of the bacillus of Nicolaier is very great, resisting for hours the action of corrosive sublimate solution, and the obstetrician who dresses the wound of infant or adult suffering from tetanus ought to refrain from attending a case of labor. Mechanical disinfection is more important than chemical, and to this end the free use of the nail-brush and the employment of green soap and sand with hot water are to be commended. But little can be expected from acting upon the uterine wound by antiseptic injections; while they may be tried, it is important to avoid all violence. Chloral, morphine, chloroform, curare, and other remedies that have been advised may be used, but probably without material benefit; the most promising treatment will be an injection of serum from an animal that has been made immune to tetanus; this method, recommended by various writers, has, according to Vinay, alleviated the symptoms in some cases, and in others seems to have effected a cure.

MENTAL DISORDERS. Under the name puerperal insanity, or puerperal psychoses, disorders of the mind occurring in pregnancy, the puerperal state, or in lactation, have been included. Probably such dis-

[1] Transactions of the American Gynecological Society, vol. ii.
[2] Müller's Geburtshülfe.
[3] Transactions of the London Obstetrical Society, vol. xxix.
[4] New York Medical Record, 1892.
[5] Kansas City Medical Index, 1895.

orders occur in 2 of 1000 labors. Approximately one-twelfth of all cases of insanity in women are puerperal.[1] Insanity appearing in the puerperium is the most frequent, and in pregnancy the rarest.

The causes chiefly are heredity, eclampsia, hysteria, chorea, renal disease, infectious puerperal maladies, epilepsy, anæmia, exhaustion from hemorrhage or from lactation: to these causes may be added toxæmia. It is stated that moral causes are more frequently observed in the higher, and physical causes in the lower, classes of society.

Melancholia, Mania, and Monomania are the chief forms. Ripping, as quoted by Kehrer,[2] gives the following statement as to combinations of mental disorders observed by him in a hospital for the insane. These combinations are presented in a decreasing frequency: 1. Primary melancholia, lasting weeks and months, then mania. 2. First melancholia, then monomania with ideas of persecution and of exaltation. 3. Mania with following confusional insanity. 4. First confusional insanity, then melancholia.

Ripping's statistics show that of 100 cases of puerperal insanity 16.4 per cent. occurred in pregnancy, 50.6 per cent. in childbed, and 33 per cent. in lactation.

Insanity during Pregnancy. It is not uncommon for a pregnant woman, especially if it be her first experience, to be at times profoundly depressed, and to be apprehensive of the most grave results from her condition. So, too, some pregnant women may be so vexed, so tormented at the prospect of being mothers, that they insist they "will go crazy," threaten to commit suicide even, hoping that the physician may be induced to rid them of their hated burden. But in neither of the cases presented is there actual insanity. The insanity of pregnancy is usually that form known as melancholia. The earlier in the pregnancy the disease appears, the more hopeful the prognosis. When mania is associated the condition is much more grave; the severity of the attack is also unfavorable. In some cases attempts at suicide may be made.[3] In the treatment care must be given to remove all sources of disquiet and worry from the patient; in some instances a complete change of scene and circumstances is advisable, even placing her in a hospital for the insane; attention must be given to nutrition and to securing regular and sufficient rest.

Insanity in the Puerperal State. It sometimes happens during labor that, under severe suffering, a woman has temporary delirium, and there may be momentary irresponsibility for words or acts; but when the labor is over, the cloud and the storm pass away, leaving the intellect perfectly clear; the condition is too transient to be called insanity, or to demand special treatment, save the mitigation of the suffering by appropriate means. Mania is the most frequent form of

[1] In examining the Report of the Pennsylvania Hospital for the Insane, 1890, I find that including those cases of mental derangement attributed to the puerperal state and to prolonged lactation, puerperal insanity embraced 15 per cent. of insane women.

[2] Müller's Handbuch.

[3] Thorburn, Lancet, June 29, 1879, reports a case of suicidal mania in a woman four months pregnant; he induced abortion—"premature labor," he calls it—and the patient in a very short time was sane. It is doubtful whether the treatment would meet general professional indorsement—at least it is to be feared if abortion were commonly recognized as the remedy, there would be many cases of feigned insanity.

puerperal insanity. Hallucinations[1] of sight and hearing, suspicion, even fear or hatred, of those hitherto loved and trusted, indifference or absolute aversion to her child occur. The disease in almost all cases appears in the first week of the puerperium, "within ten or twelve days after confinement," according to Weber. Melancholia, on the other hand, is later in its appearance, and if recovery occurs it is after a much longer period than when this follows mania.

Etiology. In regard to the causes of childbed insanity, Hoppe[2] found in his own statistics 56 per cent. in which heredity was a factor, and he states the usual proportion is 35 per cent. So, too, primiparity was a cause in 45 per cent.; the usual proportion of authors is 32 per cent. Finally, possible infection was present in 66 per cent.

Campbell Clark[3] has insisted especially upon infection as a cause of puerperal psychoses: "This toxæmia may result from diminution, modification, or even arrest of secretions and excretion of organism." He understands thereby modification in the secretion of bile, intestinal fluids, urine, lochia, and septic absorption. There may be a new or accidental intoxication—typhus in one case, scarlatina in another, alcohol given too freely, and chloroform in the lying-in; 8 were cases of well-marked septic infection. An important fact is that quite a number of eclamptics become insane, Löhlein making the proportion 5.15 per cent. and Olshausen 6 per cent.

Idanhof, of Moscow, from a study of 53 cases of puerperal insanity, states[4] that after a severe hemorrhage a powerful emotion can result in a psychosis if the subject is predisposed to mental disease, and remarks that it is indispensable during the puerperal period to preserve the woman from sepsis as well as from mental emotion.

Prognosis. The prognosis of the psychoses of childbed is, according to Spiegelberg, more favorable than that of any other puerperal form, both as regards the duration of illness and as regards complete mental and physical recovery. Restoration in the majority of cases takes place within six months.

Hoppe's statistics as to cases of puerperal insanity are: 50 per cent. cured; 9 per. cent. improved; 5 per cent. died, and 23 per cent. not cured.

Treatment. In the treatment the removal of all exciting conditions, attention to digestion, quiet of body and of mind, improvement of the blood, if that is impoverished, especially by the administration of iron, regular bathing, the securing of rest by chloral, opium, sulphonal are the essentials; several commend hyoscyamine, and Lloyd[5] speaks favorably of paraldehyde in cases of even acute mania. Of course if the disease does not readily yield to treatment at home, the sooner the patient can be removed to an asylum the better.

THE INSANITY OF LACTATION. This may appear six or seven weeks, or several months after labor, or finally a few days after ceasing

[1] The poet's picture will impress this more strongly:

"I hear a voice you cannot hear,
Which says I must not stay;
I see a hand you cannot see,
Which beckons me away."

[2] Arch. f. Psychiatrie, 1893.
[3] Journal of Medical Science, 1887. [4] Annales Médico-Psycologique, 1893.
[5] American System of Obstetrics, vol. ii.

to nurse. It may be manifested under any one of the forms, mania, monomania, melancholia, or insanity with a doubtful form, "circular insanity," all "accompanied with hallucinations and impulsive ideas, and homicidal or infanticidal tendencies."

The prognosis is favorable, most cases recovering if the child be weaned. Marcé saw 20 cured out of 26; but the cure may be slow, and may not occur for several months, or even for years (Charpentier). In case the disorder follows suspension of lactation, cure has been effected by its resumption.

Paralysis, and Neuralgia of the Lower Limbs. These disorders may be caused by direct injury in labor, and are more frequent in case of narrow pelvis, or of large, hard head; they may follow forceps delivery, especially if this delivery, rendered necessary possibly by one of the conditions just mentioned, is rapid and violent. The pain and loss of motion usually disappear in a few days; but, on the other hand, may last for weeks, and even months. Such prolongation of paresis necessarily causes some atrophy of the muscles involved.

But paresis and neuralgia may not appear until several days or even a few weeks after labor, and then be simultaneous with or follow puerperal infection. They are attributed to pressure by an exudate or by the contraction of cicatricial tissue. In these cases neuralgic is more prominent than paretic disorder. Both cease by the absorption of the exudate or its suppuration and discharge. After the subsidence of the acute stage, pain being relieved by usual means, the loss of power is sought to be prevented or cured by massage and by electricity, faradism being employed if electric contractility has not been lost; but if it has, the continuous current. The left limb is more frequently affected than the right.

CHAPTER XVI.

PUERPERAL FEVER.

PUERPERAL FEVER is probably almost coeval with the race and coextensive with the habitation of man. Hippocrates described cases of the disease; it has been observed in all lands from Iceland to India —wherever and whenever women bring forth it may appear.

While it has been especially a disease of lying-in hospitals and of dense populations, it has likewise occurred in private practice and in thinly settled territories. In recent years the use of antiseptics has reversed probably the relative frequency of the malady in hospitals and in private practice. The liability to infection belongs to every puerpera, but the fact of infection is independent of her.

It may be defined as an acute disease occurring in childbed, in quite exceptional cases manifested in labor, produced by the entrance of a poison through a wound of the genitals; the disease is contagious, and the creation of the poison in the person affected is impossible without the action of external agents—in other words, the disease is heterogenetic. The term puerperal fever dates from the beginning of the last century, and in recent years has met not a little criticism;[1] but if we do not understand by the name that a specific fever is designated, the chief objections to its use fall, and the difficulty in finding a suitable substitute is an argument for retaining the term.

Foremost among essentialists, at least in this country, was the late Dr. Fordyce Barker, who claimed that there was a fever peculiar to puerperal women, and, therefore, appropriately named puerperal fever, that the symptoms of this disease were essential, and not the consequence of any local lesions, and it was as much a distinct disease as typhus, typhoid, or relapsing fever.

This faith once commonly admitted finds few adherents to-day, or at least they restrict essential puerperal fever within such narrow limits that the faith becomes a rapidly vanishing quantity. Grandin remarks: "The future, we think, will testify to the truth of Barker's views in very exceptional instances; that is to say, while septicæmia will be the disease in nine hundred and ninety-nine cases, in the thousandth the disease will be of zymotic origin." When an empire is content with one-thousandth part of what was once its domain, it may be safely left to the harmless dream of possession and power.

The difficulty in finding a better term than puerperal fever must be obvious; therefore it seems necessary to retain this term, though admitting that it is not unobjectionable.

Cullingworth[2] has said the term puerperal fever has certain unmistakable advantages. "Everyone knows what is meant by it; it is comprehensive, and it involves no theory as to the nature of the disease."

[1] Pajot has said that the designation puerperal fever should be consigned to the museum of the antiques. Hervieux declares that there is no puerperal fever in the sense ordinarily attached to the word. "The admission of this seductive and convenient hypothesis is chaos, it is return to the infancy of the art, it is the negation of all diagnostic science, the obstacle to all progress in therapeutics in puerperal maladies."

[2] A Plea for the More General Adoption of Antiseptics in Midwifery Practice. London, 1888.

It would seem unnecessary at this day to state that puerperal fever is contagious. Nevertheless the truth is so important there is no danger of emphasizing it too strongly. Many an American practitioner can remember when leading obstetric teachers in one of our great cities taught the opposite; and everyone who was instructed by these teachers was fortunate if he did not wait to learn at the death-bed of a puerpera who, putting her supreme trust in him, perished from his ignorance, the utter falsity of the teaching.

The late Dr. Oliver Wendell Holmes, in a paper entitled "Puerperal Fever as a Private Pestilence," published in 1843, and republished in 1855, probably did more than any other American physician to correct this erroneous teaching and to convince the American profession of the contagiousness of childbed fever.[1] Many an American mother owes her life to the striking array of facts he so clearly presented in sustaining his thesis; the number saved would have been still greater if his essay had been presented to every medical graduate before engaging in practice. Among the rules Dr. Holmes suggested were the following:

"1. A physician holding himself in readiness to attend cases of midwifery should never take any active part in the post-mortem examination of cases of puerperal fever.

"2. If a physician is present at such autopsies, he should use thorough ablution, change every article of dress, and allow twenty-four hours or more to elapse before attending to any case of midwifery. It may be well to extend the same caution to cases of simple peritonitis.

"3. Similar precautions should be taken after the autopsy or surgical treatment of cases of erysipelas, if the physician is obliged to unite such offices with his obstetrical duties, which is in the highest degree inexpedient."

It will be observed that in part of the prophylaxis Dr. Holmes anticipated the teaching of Semmelweis.[2] But it is not alone from autopsies of women who died from puerperal fever or peritonitis, nor from the living who are suffering from the former disease or with erysipelas the contagion may be carried to the

[1] In Dr. Holmes's essay when republished some additions were made, and in these, referring to the criticisms made by a Philadelphia teacher of obstetrics, he thus speaks: "One unpalatable expression, I suppose the laws of construction oblige me to appropriate to myself as my reward for a certain amount of labor bestowed on the investigation of a very important question of evidence, and a statement of my own practical conclusions. I take no offence and attempt no retort. No man makes a quarrel with me over the counterpane that covers a mother with her newborn infant at her breast. There is no epithet in the vocabulary of slight and sarcasm that can reach my personal sensibilities in such a controversy. Only just so far as a disrespectful phrase may turn the student aside from the examination of the evidence, by discrediting or dishonoring the witness, does it call for any word of notice."

To this I add an extract from a letter written me in 1874 by Dr. Holmes. I had sent him a pamphlet containing a sad personal experience as to the contagiousness of puerperal fever, a doctrine which when a medical student I was taught to reject, and wrote him a brief note. From his reply, occupying nearly four pages, I take the following: "The testimony you bear to the sad fact which I laid before the public so many years confirms, if confirmation were needed, the thesis I maintained. It is thirty-one years since, April, 1843, in the 'N. E. Quarterly Journal of Medicine and Surgery,' a periodical of merit, but which died with its fourth number, I published an article which I considered settled the point of the communicability of puerperal fever from one patient to another by the accoucheur.

"Dr. —— and Dr. —— attacked my position in a way which made me ashamed, both talking like class declaimers in the face of facts which people of common-sense could only interpret in one way. I confess that I declaimed too, but I only fired powder after firing shot and shell. I have been sick of the name of 'Professor' ever since.

"Hundreds of lives might have been saved if they had enforced the disagreeable truth I had made plain enough for those who would not shut their eyes."

[2] In a biographical sketch of Semmelweis by Dr. Herdegen, American Journal of Obstetrics, 1885, the following incident is related: "A martyr to the new doctrine was found in Michaelis, the professor of obstetrics at the University of Kiel, and one of the first obstetricians of all time, whose work on the 'Contracted Pelvis' is now considered classical, all our modern views on the mechanism of labor being founded upon it A near relation of his, whom he had attended in labor, died of puerperal fever. Convinced of the correctness of Sammelweis's idea, and certain that it was he who brought her death instead of help, being at the time much occupied with autopsies on patients dead of puerperal fever, he laid himself on the railway track and was crushed by the train."

puerpera. Contact with corpses in autopsies or in dissections may be the origin of the infection.

In the very interesting sketch[1] of Semmelweis, by Winckel, it appears that S. was first led to recognize an important source of puerperal infection by the fatal illness of Professor Koletschka, March, 1847, of the University of Vienna, who having received a dissection wound had double pleuritis, pericarditis, peritonitis, meningitis, and a day before his death there was a metastasis to the eye. Semmelweis concluded that there was an identity between the disease and that of which so many hundreds of puerperal women perished. In the school for instruction in practical midwifery, with which he was connected, there were two departments, one for the teaching of medical students, and the other for that of midwives; in the former the mortality was 11.4 per cent., while in the latter it was only 2.7 per cent. He then began, May, 1847, to require students to wash their hands in chlorine water before making vaginal examinations, and in the year 1848 the puerperal mortality was reduced to 1.27 per cent.

It will thus be seen that the obstetrician anticipated, in practical antisepsis, Lister and Pasteur.

Winckel states that only Lange, in Heidelberg, and Kugelmann, in Hannover, accepted unconditionally the teaching of Semmelweis, while it was rejected up to 1864 by Hecker, Siebold, Spiegelberg, Virchow, and many others. Winckel in 1861–62 was assistant under Professor E. Martin in the obstetric department of the Royal Frauenklinik of Berlin, and in harmony with his chief, and on the ground of the observations of Semmelweis the slightest contact with cadavers and autopsies was strictly avoided.

Semmelweis died in 1865, of blood-poisoning, having injured his finger in an operation upon a newborn, and from this injury there was a metastatic abscess between the muscles of the chest that perforated the pleura, and pyopneumothorax resulted.

Another important fact in the etiology of puerperal fever was observed by the Vienna obstetrician. A pregnant woman suffering from advanced uterine cancer was in the ward. The precaution which had been for some time used, washing the hands in a solution of chloride of lime before making a digital examination, was neglected. The labor was prolonged for several days. As the case was very grave and rare, the students were eager to examine. Fourteen women who were delivered in the interval, and who consequently had been "touched" by the pupils, had puerperal fever and died. With the exception of these unfot unate women there were no others sick.

Siredey mentions seeing two women die from septicæmia who were delivered in the house of a sage-femme who had living with her her mother, suffering from uterine cancer; the midwife gave her mother vaginal injections and the other attentions her state required, at the same time continuing her obstetric work.

Kaltenbach has stated that cases are known in which midwives suffering with purulent discharge from ulcerated bone, from blennorrhœa of dakryocystitis (Fritsch), or syphilitic necrosis of the jaw (Dalton), have infected a number of lying-in women, thus causing their death.

The instances are many in which hospital surgeons or physicians in general practice, going from patients with suppurating wounds to women in confinement, have carried fatal infection.

Charpentier mentions the following case, in which the poison was communicated several days after labor: The wife of a physician, the seventeenth day after labor, was convalescing, when her husband, who had just returned from visiting a patient with diffuse phlegmon of the thigh, had the unfortunate thought of examining her to learn whether the uterus had returned to its normal state. The following day she had a violent chill, followed by all the phenomena characteristic of a purulent affection, and died the thirty-third day after labor.

Local disease of the practitioner has, in some instances, been the source of the poison. Siredey relates the history of a physician who, in consequence of a suppurating adenoma of his neck, had introduced a rubber tube as a seton; previous to this he had attended eight hundred cases of labor without an accident, and now three women whom he delivered within three weeks were attacked with

[1] Münchener med. Wochenschrift, 1893, No. 46.

puerperal fever. He discontinued obstetric practice until the suppuration ceased. But the most striking illustration was given by a Philadelphia physician several years ago, Dr. David Rutter. He had nearly seventy cases of puerperal fever occurring within less than twelve months, while no instance of the disease was observed in the patients of any other accoucheur practising in the same district. Harris[1] states that Dr. Rutter had ozæna, which in time much disfigured him from its effect upon the contour of his nose. He was unfortunately inoculated upon his index finger from a patient, and neglected the pustule. He had ninety-five cases of puerperal septicæmia in four years and nine months, with eighteen deaths. Siredey, in referring to the etiology of the puerperal fever which so frequently occurred in this physician's practice that he was indeed "a walking pestilence," says that the explanation suggested by Harris was true, for Heiberg has discovered septic bacteria in the muco-pus of an analogous case.

In lying-in hospitals the contagion may be communicated by using the sponges, basins, syringes, bed-clothing, beds, etc., that have been employed in infectious cases. Schröder has said that the fluids, even non-purulent or ichorous, from phlegmon or erysipelas, diphtheria, and scarlatina, from parts of dead bodies, especially in case of death from septic disease, sanies from cancer, and putrefying products of abortion, experience has taught to be especially feared.

Kucher[2] states that: "Some authors, among others Atthill, assert that the poisons of some zymotic diseases, as scarlatina, typhus, typhoid fevers, etc., become so changed by the conditions of the puerperal state as to produce puerperal fever. This assertion has often been made, but it is not supported by any convincing observations. Neither have any cases of scarlatina, typhus, or typhoid fever produced by puerperal fever been observed."

The second proposition contained in the definition which needs exposition is that the disease is heterogenetic. Some authorities have not been satisfied with one puerperal fever, but insist upon several, each having a different etiology. In most cases, for example, nine out of ten, careful examination soon traces the disease to an external cause, so that all will admit it to be heterogenetic. But again, other cases occur for which no external cause is discovered, and, therefore, the hypothesis of self-infection or autogenesis is proposed. We do not thus reason as to other contagious diseases when we are unable, as we often are, to discover the source of the contagion. For example, in many cases of scarlet fever we cannot tell whence the disease came, but we never say it was generated in the patient. The doctrine of autogenesis is a confession of ignorance, the creed of fatalism, the cry of despair. It is more rational when we meet with cases of puerperal infection whose origin we do not know, but that have the same history as others the source of which we can trace to an external cause, and that have the same evolution and the same infecting power, to conclude that they too come from like sources, though the connecting thread is so fine that it eludes our vision, than to erect an altar to the unknown god of autogenesis, and imagine that we have explained the mystery. Self-infection means that the house sets itself on fire, and that the powder magazine is exploded without any mischievous spark. What security can the practitioner give his patient when the foe which brings swift death is created within her, and when she kills herself? This

[1] Note to Playfair's Midwifery. [2] Puerperal Convalescence.

doctrine of the autogenesis of puerperal septicæmia is, to my mind, the very pessimism of obstetric medicine. Why should the city guard its gates when the enemy can already be in the citadel and begin the battle there? Two[1] of the best recent authorities upon puerperal diseases have very positively given their opinion in regard to the question of autogenesis and heterogenesis. Siredey said, "I do not believe in gravidic auto-infection, and my opinion is that septic puerperal maladies are due to hetero-infection." Fritsch is still more positive: "To admit the existence of a spontaneous infection is to take a long step backward."

Winckel regards self-infection as, according to his experience, quite exceptional, "but, like the belief in miasm, it relieves the conscience, and therefore will always retain a considerable number of adherents."

Dr. Barnes, who, as indeed many other obstetric authorities, upholds the doctrine of several puerperal fevers, in the following passage expresses his views as to their etiology. Before presenting this passage, it may be said his position in regard to the infection of the puerpera originating from erysipelas, is sustained by much clinical evidence of many years, and by the fact that there is a strong probability the streptococcus pyogenes is identical with the streptococcus of erysipelas; but so far as the influence of the other diseases mentioned, the reader is referred to the statement of Kucher on a previous page:

"The puerperal fevers may be classified under the two great divisions of autogenetic and heterogenetic. *a*. The autogenetic fevers are: 1. The simple excretory puerperal fever, the result of endosepsis, or the arrest of the excretion of waste stuff of involution: it is especially prone to arise in damp cold weather. This form complicates all other fevers, even the septicæmic form. 2. The fever resulting from the absorption of foul stuff from the parturient canal, either from the unbroken mucous surface, or by the open mouths of vessels, or from traumatic surfaces; this is autoseptic. This form is also likely to complicate other fevers. 3. This, the proper septicæmic puerperal fever, is revealed under the forms of metritis, peritonitis, pelvic cellulitis, thrombosis and general toxæmia. *b*. The heterogenetic fevers are due to a poison from without. These may be divided into (1) the cadaveric poison which wrought such havoc before the days of Semmelweis, the septic stuff from other puerperæ, animal poisons of obscure origin; and (2) the known zymotic poisons, as smallpox, scarlatina, typhoid, diphtheria, erysipelas."

Here are at least five different forms of puerperal fever! How are they to be distinguished from each other? The difficulty is increased by the fact that Dr. Barnes states, "number 1" complicates all other fevers, and again, that "number 2" is likely to complicate other fevers. How indeed at the bedside know whether the disease is autogenetic, or heterogenetic? Such divisions must seem to most arbitrary, and show analysis pushed to an extreme. They, in my opinion, lead to darkness and confusion rather than to light and order.

In general it may be stated that the progress of knowledge tends to diminish rather than to increase the number of causes. Hence there is an argument of probability against the views that have been presented. It will be admitted that the lessened morbidity and mortality of puerperæ during the last few years are due to the fact that antiseptics are so generally used in obstetric practice. But how could these have any effect in preventing fever caused by failure of excretion? If there be "foul stuff" to be absorbed by the parturient canal, that stuff has become foul because germs of decomposition have found access to it.

[1] Auvard bears like testimony: "Puerperal septicæmia is undoubtedly a microbian malady, a *hetero-intoxication*, thus absolutely and essentially opposite to eclampsia, due to chemical agents produced by the organism and of which the insufficient elimination causes an *auto-intoxication*."

Kehrer,[1] who speaks of external, internal, and mixed infection—illustrating the latter by supposing that the obstetrician introduces an aseptic finger into the vagina containing infectious matter, and carries some of this into the aseptic uterus, finds fault with my statement, asserting that while it is just and reasonable to criticise carefully all cases of self-infection, so that assistants and pupils may not be careless, but be ever alert and watchful, it will not do to deny the possibility of such infection. In completing the picture of the fortress I have given, he observes that "hundreds of fortresses have fallen because the enemy crept in or traitors were in the camp. A faithful commander is he who not only keeps a watchful eye upon the besiegers, but also upon the besieged. Had we no enemies, no pathogenic micro-organisms in the genital tract, the word self-infection might be dropped, but as long as we are not safe from this internal enemy it must be retained."

It is well known that if no vaginal examination is made during labor, the occurrence of infection is exceedingly rare. Further, the more protracted and difficult the labor, the more frequently interference, manual or instrumental, is required, and especially if artificial removal of the placenta is necessary, the greater the liability to morbidity, and also mortality in the puerperium. These facts speak for the introduction of germs from without, and, therefore, the infection is heterogenetic. Nevertheless, the explanation given by Kehrer of mixed infection may be accepted as the origin of puerperal fever in rare cases.

Runge states that the pathogenic germs of infection are almost without exception streptococci, according to Bumm. Döderlein has concluded, from his investigations, that the normal vaginal secretion never contains pathogenic bacteria, and this has been upheld by other investigators; the acidity of the vagina protects against their forming colonies. Bumm holds that it is in the highest degree improbable that pathogenic cocci may have a virulence in the progress of normal labor so as to be injurious, leading to self-infection. Whether in a pathological labor such virulence may be developed is allowed to be an open question.

Place of Entrance of Puerperal Poison. Admitting that different forms of puerperal fever depend upon germs, or their products, where do these get access? Chiefly through wounds of the cervix in the greater number of cases, carried there by an unclean finger in many instances, the infection almost always is the consequence of contact; less frequently from the vagina and vulva, and still less from the uterine cavity. This is the general statement of obstetric writers; but it may be disputed.

Bumm,[2] referring to the results of Widal, in examining twelve cases of fatal puerperal septicæmia, and his own results, asserts the endometrium as the gate of entrance of the infection. He remarks: "The great importance which the wound of the puerperal uterus has with reference to the generalization of the infection, nevertheless, does not exclude the possibility of infection by another way. Moreover, solutions of continuity at the surface, lesions, wounds situated upon any part of the genitals, perineum, vagina, may be the point of departure of an erysipelas, of a general infection. But usually the processes developed at the level of the perineum, or of the vagina, remain limited to these regions. If the virus does not reach the endometrium, the puerperal processes cure after having determined a more or less acute febrile reaction."

[1] Müller's Handbuch der Geburtshülfe.

[2] Arch. f. Gynäkol., 1891.

Influence of the Air. It has been asserted, more especially by some French obstetricians,[1] that the uterus may be infected through the blood; infection by the mephitism of the air, as Guéniot has said, may result from the penetration of septic vibrions through the lungs. Chantemesse asserts that puerperal infection, instead of coming from without, may come from within, germs finding their way from the blood to the uterus. Prioleau says: "The infected blood of the parturient carries the germs to the place of the placental wound; pullulation and increase of the virulence of these germs in the favorable conditions (constant temperature and suitable medium), lessened phagocytosis, consequent upon an infection already existing."

These views, however, do not meet with general professional acceptance; their adoption would seem a long step backward in explaining the etiology of puerperal fever.

Temperature. Connected with the condition of the air is that of temperature in causing infection. Hirsch[2] shows very clearly, as generally known by the profession, the greater prevalence of the disease in cold than in warm weather; but he also states that the influence of cold is indirect, that it is reasonable to suppose it is the change in hygienic conditions of the lying-in hospitals brought about by the cold season which furnishes the real grounds for the rise of the sick-rate and the death-rate.

Mildness or Severity of Infection. Bacteriology has by no means solved all the problems of puerperal disease; it has completely changed many beliefs once held, but it has also presented new questions; the light of knowledge has increased, but it has also revealed a wider area of ignorance. Among these problems is this, why in one case the infection may be mild and in another very dangerous. Just as, using the language of Kaltenbach, an etiological classification of puerperal wound-diseases is impossible according to the botanical quality of the active germs, so from the same agents slight as well as grave diseases arise, and besides a mixed infection may occur.

The explanations usually offered are that the susceptibility and receptivity of the subjects vary, and also the deleteriousness of the germs themselves is not constant, and the number of these may be greater in the severe cases. Not only a protracted labor predisposes to infection—in general this accident is more frequent after the birth of boys than of girls, but also very great distention of the uterus, because the latter condition is not uniformly followed by perfect contraction; so, too, among important influences of this sort must be placed acute anæmia, and hence in part a relative frequency of puerperal fever in placenta prævia.

That the greater enlargement of uterine vessels, both blood and lymph, in completed pregnancy, and especially if the uterus be greatly developed, makes a greater liability to grave disease, than if the pregnancy have an early interruption, is reasonable and probable. Bumm,[3] in his histological researches upon puerperal endometritis, remarks: "It is a common belief that a general septic infection generalized, is a rare event in miscarriage, though endometritis is a

[1] Archives de Tocologie et de Gynécologie, January, 1894.
[2] Handbook of Geographical and Historical Pathology.
[3] Arch. f. Gynäkol., 1891.

very frequent complication. The cause of this fact is in the slight development of the bloodvessels and lymphatics in the first months of pregnancy (Chantemesse). On the other hand, in twin pregnancy and in deficient retraction of the uterus general septic infection more readily occurs."

Time of Infection. This may be in pregnancy, in labor, or during the lying-in. Of course, that a pregnant woman may be infected an artificial traumatism, as in a rude vaginal examination, or in an operation upon the sexual organs, is necessary; there must be a door opened for the entrance of germs or of their products. By far the most frequent infection is in labor, and the periods of special danger are the first and the last; that is, during dilatation of the os and the delivery of the placenta, especially if the hand is introduced into the uterus.

Puerperal Ulcer. This usually appears the second or third day after labor, occupying some portion of the vulva. It is grayish-yellow, with irregular, swelled margins, while the adjacent parts are red; the labium majus, if it be situated upon it, is œdematous. The ulcer may be the starting-point of erysipelas, but this is rare, and, of course, is impossible without the presence of the erysipelas coccus. Its covering has sometimes been spoken of as diphtheritic, but it probably would be better to describe it as diphtheroid.

Spiegelberg stated that the membrane, though commonly called diphtheritic, has nothing whatever to do with true diphtheria (Birch-Hirschfeld); it consists of fibrin and granular detritus, which has resulted in the disintegration of the superficial layer of the injured tissues and of pus-corpuscles; it is an accompaniment of the regenerating process which is connected with the suppuration. Siredey and Winckel also deny that the membrane is diphtheritic.

The patient, without the occurrence of a chill, and with little disturbance of the pulse, has an increased temperature, possibly 103° F., and chiefly complains of a feeling of fulness and burning of the parts, and urination is usually painful.

The treatment of a puerperal ulcer of the vulva is by scrupulous cleanliness and antiseptics. It may be washed with warm water and creolin or a 1 per cent. solution of lysol, and pencilled with tincture of iodine and dusted with iodoform.

Puerperal Colpitis. Inflammation of the vagina may result from mechanical injuries in labor, or it may be caused by chemical injuries, as, for example, when the vaginal tampon contains one of the iron salts, or strong solutions are used for vaginal injections; especially is evil from the long-continued use of the tampon to be feared, simply from its pressure causing epithelial detachment. There is usually fever, but no remarkable participation of the pulse. The treatment will be in almost all cases only antiseptic vaginal injections two or three times in twenty-four hours; probably lysol, 1 to 2 per cent., may be most usefully employed.

Usually external injuries, including rupture of the perineum, even those of the vagina, are rarely the causes of general infection; local treatment is, as a rule, sufficient for the ulceration which may result.

Puerperal Endometritis. This is one of the most frequent forms of disease in women after labor or miscarriage. In the majority of

cases it remains limited to the inner surface of the uterus, but in some it is the forerunner of, or associated with, the gravest manifestation of puerperal fever.

In regard to the etiology of puerperal endometritis the following statement of Krönig,[1] derived from his recent studies, is of importance. Of 179 cases of endometritis of women in childbed, 75 were caused by the streptococcus pyogenes; 4 by the staphylococcus pyogenes aureus; 50 by the gonococcus of Neisser; and 50 by the bacteria of decomposition. The last, therefore, were examples of sapræmia.

The studies[2] made at Berlin by Goldscheider contrast somewhat with the results obtained by Krönig at Leipzig. Thus the former found of 68 cases of puerperal fever there were only 12 cases—5 after labor at term and 7 after abortion—of sapræmia; moreover, some, at least, of the sapræmic cases followed rupture of the perineum.

The characteristic symptoms of puerperal endometritis are fever, sensibility of the uterus, and changed lochial flow. Chill or chilliness marks the beginning of the attack and is followed by fever, the temperature reaching 102°–104° F., and there is usually a morning remission; the lochial discharge is frequently offensive in odor, is more abundant, and may have a deep-brown color.

There are two forms of puerperal endometritis, purulent and septic. In the former chemical products of putrefaction are absorbed in the uterine cavity and cause fever.

Bumm describes the superficial layer of the caduca as containing numerous organisms—rods, long filaments, and cocci—forming colonies; but a layer of granular matter is found at the level of the muscular substance, forming what he calls the zone of reaction, and micro-organisms do not penetrate this zone.

In septic endometritis, beside the germs of putrefaction, more or less numerous, according to the case, there are the characteristic cocci in chain-form. But here again the granular zone is a barrier to the penetration of the germs into the parenchymatous structure.

Those cases in which a general infection begins from septic endometritis will be considered hereafter with reference to the entrance of germs.

Treatment. An ice-bag is placed over the uterus to excite its contraction, and this action is assisted by ergot. If the offensive odor of the lochia does not disappear by the use of vaginal injections, those in the uterus are generally regarded as indicated. For this purpose an irrigator or fountain syringe will be employed, with Bozeman's catheter as modified by Fritsch. A solution of corrosive sublimate or a strong solution of carbolic acid will not be used, but rather, lysol or creolin. Care must be taken that no air enters during the irrigation, that there is a free exit for the fluid from the uterus, and that the irrigator is held but slightly above the level of the patient, so that the entering stream has but little force. Even with all these precautions unpleasant symptoms may follow irrigation. For example, the patient has a chill and a higher temperature for a time than she had before.

[1] Op. cit.
[2] Klinische und bakteriologische Mittheilungen über Sepsis puerperalis. Charité-annalen xviii, Cent. f. Gynäkol., 1894.

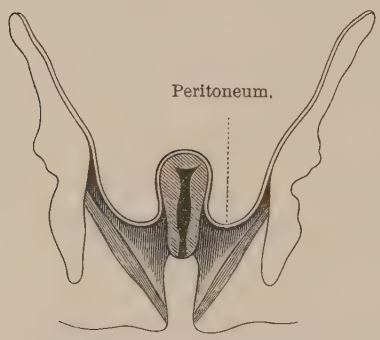
Kaltenbach, while in doubt as to the cause, whether from infection through fresh traumatism caused by the tube, destruction of red corpuscles, the entrance of septic stuff, or of the injected fluid into blood-vessels, etc., regarded the symptoms as of no unfavorable character.

In rare instances the patient is, during an irrigation, attacked with sudden dyspnœa, and even convulsions with unconsciousness may follow. Therefore, let the obstetrician watch the patient's countenance during the operation, and cease at the first manifestation of distress.

Uterine[1] injections are not now regarded with as much favor as they were a short time since in the treatment of endometritis. Thus, Schrader[2] condemns them, and Krönig[3] observes: "Clinical experience, however, has taught us that washing out the uterus brings no benefit. Also experimental examinations made by the reporter prove that the various antiseptics do not destroy the germs. Instead of the local, the general therapeia is of the greatest importance." Nevertheless, while uterine irrigation should not be rashly resorted to, and when used it should be with the precautions mentioned, there will in many cases follow the discharge of retained clots, fragments of membranes, or of placenta effected by the washing, lessened temperature, and rapid recovery.

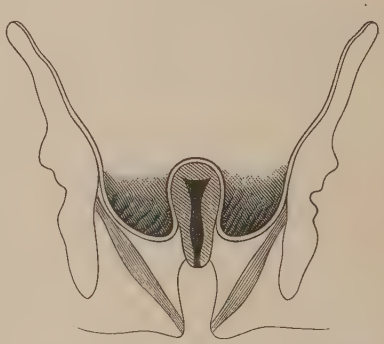
Parametritis, Perimetritis. Inflammation of the connective tissue adjacent to the uterus is called parametritis, sometimes circumscribed parametritis, while perimetritis is applied to inflammation of the peritoneum belonging to the uterus or adjacent to it. In some cases the two forms of disease are associated.

Fig. 268.



Scheme of Exudates in Parametritis. (After Fehling.)

Fig. 269.



Scheme of Exudates in Perimetritis. (After Fehling.)

Parametritis generally originates from a tear of the cervix or a deep tear of the perineum; in other cases it is caused by a pressure-necrosis of the cervix or of the vaginal vault (Kaltenbach). If from pressure-necrosis, saprophytes are found in the exudation; gonococci, too, have been considered as possible causes of the inflammation; but the usual

[1] The prefix intra, as commonly used, is unnecessary; it would be just as appropriate to speak of intra-vaginal injection or irrigation.
[2] Woher der therapeutische Misserfolg der Antisepsis beim Puerperalfieber? Leipzig, 1894.
[3] Op. cit.

germs found in the effusion are staphylococci and streptococci. The exudate may be on one or on both sides.

Two forms of parametritis are recognized, mild and grave, the latter occurring in severe sepsis; fortunately, the former is much the more frequent. The disease may begin immediately after labor, a chill occurring and the temperature rising to 103°–104° F.; but in most cases the disease is much later, often, too, insidious in its advent; it may occur even five to ten days after delivery. In rare instances there may be no change in the pulse or temperature. Ahlfeld mentions having seen four such cases. If fever occurs, it may have morning remissions, and lessens in a short time.

The characteristic effusion occurs at the side of the cervix and in the base of the broad ligament. At first this exudate cannot be recognized by vaginal touch, only a resistance and increased sensibility; but after a few days a tumor the size of a hen's egg, possibly, or even as large as the fist, sometimes larger, may be found in many cases.

The tumor, if the exudate is only upon one side, pushes the uterus to the opposite side. In the great majority of cases, whether a distinct tumor is formed or not, absorption of the effusion occurs, and recovery is not greatly delayed. In some cases suppuration takes place, and the abscess may spontaneously open into the rectum, the vagina, or the bladder, more rarely into the uterus, or above Poupart's ligament, and still more rarely into the peritoneal cavity.

Depending upon the position and size of the exudate the patient may have numbness, pain, and paresis of the limb belonging to the side affected; again, an effusion in the vicinity of the psoas muscle may compel her to keep the knee bent and the hip immobile.

The diffuse swelling in the vicinity of the uterus and its doughy feeling are regarded as characteristic; bimanual examination will be useful after eight to ten days if the exudate is large. Runge states that in perimetritis, a local peritonitis, the pain and the fever are quite prominent, while circumscribed parametritis is more insidious in its attack, and there is early formation of an exudate. But it should be remembered that the two affections may be associated, and that even in autopsies it is sometimes impossible to decide which was the primary disease.

The prognosis is generally favorable. In rare cases the patient may die from exhaustion in consequence of prolonged suppuration; and in others in which the exudate is considerable months may pass before complete recovery; in still other cases the nutrition of the uterus and ovaries by the abundant proliferation of connective tissue is so interfered with that sterility, amenorrhœa, and a premature menopause follow.[1]

In the treatment antiseptic vaginal injections will be employed if the lochia are at all offensive in odor, ice will be applied to the abdomen over the inflamed part; this application, it is believed, prevents the further wandering of micrococci by causing contraction of lymphatics and bloodvessels, and certainly it contributes much to the patient's comfort; pain is relieved and peristalsis prevented by opium—Ahlfeld asserts that ice and opium are sovereign means in beginning parame-

[1] Ahlfeld.

tritis; calomel and castor-oil may be used in case constipation is not removed by suitable diet or by rectal injections.

If this treatment has failed, and the exudate does not notably lessen by the third week, the internal administration of potassic iodide and the application to the abdomen over the tumor of Churchill's tincture of iodine are generally recommended; there may be used also the wet pack, more especially at night.

If suppuration should occur, a free opening and drainage are indicated. Fritsch[1] has recommended early opening of the abscess, from the second to the beginning of the third week, stating that cure is thus promptly effected. The following is his method of operating: He makes an incision in the vagina at the most prominent part of the parametritic tumor; spurting vessels are immediately ligated; the finger is used again to feel the tumor through this opening, and very carefully the knife opens the pus-collection. The pus escaping, the opening is enlarged with the finger or with the forceps, and the sac is washed out with a stream of water having slight force, a double catheter being used. Then the finger is cautiously passed into the cavity to explore it, and finding narrow recesses in it, they are widened so that all the contents can readily escape. Next the sac is packed gently with iodoform gauze. The after-treatment is daily washing out the sac and introducing a fresh tampon.

Perimetritis, having as its synonymes circumscribed peritonitis and pelviperitonitis, begins with a chill, followed by fever, the temperature rising to 104° F. or somewhat higher. The pain is more intense than in parametritis; it is sharp, knife-like, characteristic of inflammation of serous membranes. There may be vomiting, there is great tenderness in the lower part of the abdomen, and this is tympanitic. The causes of the disease are extension of a parametritis or of an ovaritis to the peritoneum, pressure-necrosis of the posterior wall of the cervix and of the vaginal vault, and, according to Kaltenbach, there may be peritonitis in completely intact sexual organs. It is also commonly taught that a peritoneal inflammation may result from an extension of an endometritis to the tubes, and their purulent contents escaping into the abdominal cavity. The researches of Bumm render this etiology doubtful, so far as such extension of disease of the endometrium is concerned. He states[2] that he believes general peritonitis from streptococci results from the direct penetration through the uterine wall to the serous membrane of the infectious germs, and propagation by the oviduct is absolutely exceptional. But this is far from denying that a pyosalpinx antedating pregnancy may rupture during labor or lying-in, and the escaping pus cause peritonitis.

Peritoneal inflammation is usually soon followed by an exudate which becomes encapsulated, shut off from the general peritoneal cavity. In the majority of cases recovery takes place without injury to parts, but in others adhesions between coils of intestines and then with the broad ligaments, the abdominal wall, tubes, ovaries, and uterus may ensue, and in still others suppuration, the pus usually finding an exit through the rectum, or the vagina, or bladder.

[1] Krankheiten der Frauenh. 6th edition, 1894.

[2] Op. cit.

In the treatment absolute rest for the patient is first in importance. Many would begin with Epsom salt, and then use the ice-bag and opium. Vaginal injections of an antiseptic solution are indicated if the discharge is offensive, and washing out the uterus with a similar solution if purulent endometritis is present. Later, after the fever has gone, a blister may hasten absorption, and iodine may be used to the vaginal vault, and also tampons of icthyol and glycerin may be employed for the same purpose. Suppuration having occurred, the pus must be given early exit.

Runge asserts that the majority of so-called pelvic abscesses are at all events of parametritic origin—a statement that at least the majority of American practitioners will be slow to accept.

Ahlfeld suggests that probably, more frequently than has hitherto been recognized, the bacterium coli commune, whose entrance through the intestinal wall is favored by the disorders of nutrition, is present in these encapsulated centres, and, therefore, the adhesions of the serous covering of the intestine with other serous parts.

Phlegmasia Alba Dolens. This form of disease usually occurs from the fourth to the twelfth day after delivery, but there may be an interval of two or three, or even five or six weeks.[1] "Considered successively as a milk-metastasis, a rheumatic affection, a neuritis, an inflammation," various theories have been advanced to explain this affection of women in childbed. The chief characteristics are pain and swelling of one of the lower limbs, this swelling being of a white color. One of the oldest theories in regard to the disease is that which attributed it to a deposit of milk in the affected member, and which is perpetuated in the once professional but now only popular designation of milk-leg. The theory of inflammation of the connective tissue, and then that which made it depend upon inflammation of the veins, probably were next in order. The last was advocated by Davis in 1817, and is now generally accepted.[2] Inflammation of the lymphatics has been maintained by some as the cause. By still others it is claimed that spontaneous coagulation of the blood occurs in the affected vessels; the hyperinotic condition of the blood is an admitted fact, and then there is assumed an inopexia, which is the final agent in producing a physiological thrombosis, and the lesions of the walls of the vessel are consecutive to its spontaneous obstruction. As has been already stated, it is now generally held that phlegmasia alba dolens of childbed is caused by phlebitis—that phlebitis being an extension of the disease from the vessels of the uterus.

Symptoms. Pain and swelling are the most striking characteristics of the affection. Pain precedes the swelling, and in many cases is felt for some hours in the lower part of the abdomen at the pelvic inlet; possibly a chill occurs before the pain. With or without the pelvic pain first occurring, pain is felt below Poupart's ligament, and soon extends down the thigh to the leg. The swelling follows, and may

[1] Greslon has given (Nouv. Arch. d'Obstétrique et de Gynécologie) a case of phlegmasia alba dolens coming on the twenty-seventh day after delivery.

I had a case primarily of infectious phlebitis in which this adhesive phlebitis did not appear until four weeks after labor; the patient recovered after a very long illness.

[2] Kaltenbach has held that the disease may arise without thrombosis of the femoral vein, in consequence of lymph-stasis.

begin in the gluteal region, or upon the upper anterior face of the thigh, thence extending to the leg and foot; the rapidity of the extension is so great that in some cases the entire limb is involved within a few hours. The swelling is so uniform that the limb has a symmetrical shape, or resembles a truncated cone, the base of which is at the upper end of the thigh; it is so great that sometimes the limb seems double its natural size. In most cases it is limited to the member, but in some it involves the hypogastric region. The skin is white, tense, and shining. By palpation, which ought to be done very gently, the obstructed veins are felt as solid, irregular cords. The limb is sensitive to pressure where the inflamed vessels are felt, but after the first day or two no severe spontaneous pain, but chiefly discomfort, is experienced; the member becomes inert, useless, the patient being unable to move it.

In almost all cases premonitory symptoms occur; in some the disease may appear in the course of a more or less severe attack of pyæmia, while in others there have been occasional manifestations of fever and abdominal pain, a sort of masked infection, and a threatening of more serious danger, or, at least, some deviation from normal convalescence. The occurrence of the disease without some prior evidence of a pathological condition of the uterus, or in its vicinity, is quite exceptional.

Progress and Termination. Fever with some pain continues for about two weeks, and then in the great majority of cases the swelling begins to subside, the subsidence taking place very much more slowly than the accession. In rare instances the other limb is also affected. Resolution is the usual termination, but the limb is a long time recovering its lost power and natural feeling, being, as has been said, like a wooden leg; even for months the foot and leg swell after exercise or standing. In some instances a permanent œdema is the result. Among the perils of the patient are breaking down of the clot, with consequent general infection, or detachment of a portion of it, with pulmonary embolism, and sudden or rapid death follows.

Crural Phlegmon.[1] This is a rarer affection in the puerpera than the preceding. It is a phlegmon of the thigh, with primary disease of the skin or the subcutaneous or intermuscular cellular tissue; for instance, in the course of parametritis, in which the vessel walls may take part, when at times even secondary thrombi form in them, but in which they are not always implicated. The treatment advised by Winckel is early, free, long, and deep incisions through the diseased integument in order to relieve the swelling, and evacuate, as soon as possible, the pus which has been formed. The wounds are then irrigated with a solution of carbolic acid, drained, and treated with iodoform powder.

The Treatment of Phlegmasia Alba Dolens. Active treatment of this manifestation of puerperal infection should not be employed, and hence leeching, cupping, and blistering, which were once used, are to be rejected. In regard to the last, Siredey says he positively proscribes blisters because of the injurious action which they have upon the kidneys, and of the predisposition to gangrene of a member the circulation of which is profoundly disturbed. As the

[1] Winckel.

greatest peril to life in the affection arises from the detachment of a portion of the clot and consequent pulmonary embolism, the limb should be kept at perfect rest, and all friction of it avoided. Barker advised elevating the limb at an angle above the trunk by raising the lower part of the mattress, "not so much to favor the gravitation of fluids back toward the trunk, as to retard the gravitation of the blood toward the limb." Siredey, however, objected to the elevation of the member on the ground that it facilitates the detachment of clots, and he directs it to be kept in a horizontal position. Certainly the elevation does not add to the comfort of the patient, and it is better to follow Siredey's direction. The affected member should be protected from the pressure of the bed-clothes, and wrapped in cotton batting, then covered with oil-silk. Where there is great pain in the limb Barker advised a liniment composed of six ounces of the compound soap liniment, one ounce and a half of laudanum, and half an ounce each of tincture of aconite root and extract of belladonna. Opium will be necessary in many cases to relieve pain and restlessness and to secure sleep.

After all fever has ceased, and the pain and œdema have disappeared, the patient may be changed from the bed to a lounge, then in a few days sit for a while in a chair, and after this she may stand or walk; an immediate change from the horizontal to an erect position must be positively forbidden. When she begins to use the limb a properly applied bandage adds very greatly to her comfort, and to some extent prevents the swelling which may for some months occur after exercise.

Sapræmia. This name, originating with Matthews Duncan, 1880, is applied to a blood-poisoning from the absorption of chemical products resulting from the action of saprophytes; germs themselves do not enter the blood or the lymph. It is sometimes called a putrid fever, or a resorption fever. The product of the action of the bacteria of decomposition may be found in some part of the genital canal, *e. g.*, in certain cases of rupture of the perineum, or in the uterine cavity, as in purulent endometritis.

In the majority of cases the discharge is offensive, whether from the uterine cavity or not, and sapræmia may begin as in a grave form of puerperal fever, but usually the temperature is not more than 101.5°. Local treatment promptly ends the disease; of course, this local treatment is applying antiseptics.

The Severe Forms of Puerperal Infection. Having considered the milder manifestations of puerperal wound-diseases, we have finally to present those of a grave character. They are divided according as the infectious agent enters the lymphatics or the veins, the first being included under *Septicæmia*, and the second under *Pyæmia*.

Autopsies do not always show a perfect boundary-line between septicæmia and pyæmia, and therefore a mixed infection must be admitted, as, indeed, clinical observation proves. So, too, sapræmia and septicæmia may be associated, and here again a mixed infection is to be acknowledged.

The former variety of mixed infection does not rest entirely upon clinical observation and autopsies, but has also been proved etiologically by Bumm, for he found in the lymphatics and veins of the uterus, in one case, streptococci.

Entrance of Germs in Lymph-vessels and in Bloodvessels. Bumm states that, examining a great number of sections of the uterus of a woman dead from septicæmia, he has always succeeded in discovering the passage of germs from the surface into the openings of the lymph-vessels; at some points these fine entrances are completely filled with germs, and the cocci may be found penetrating the neighboring tissues. If the process is more advanced, the lymphatics are filled with cocci, and from this centre the germs radiate in thick trains toward the muscular substance. In the vicinity a zone of reaction, formed of round cells, is seen. If death is delayed, this circumscribing inflammation may cause liquefaction of all the infected mass, promoted by diapadesis of white cells, transforming it into a purulent cavity. The condition which has been described as lymph-spaces filled with pus in the wall of the septic uterus are really purulent cavities, the consequence of destruction of the surrounding muscular tissue. He has several times found the muscular tissue and the lymphatics up to the serous membrane abounding in cocci. The tubes in their internal half had a sound mucous membrane, and no cocci were found, but cocci were in the pavilion and extending as far as the contracted portion of the tube. In all cases he found that infection of the tube was propagated from the abdominal cavity.

In the uterus of a patient dead from pyæmia he found in the part of a thrombus at the placental site, adjacent to the surface of the caduca, both streptococci and saprophytes; granular degeneration of the thrombus was seen; more deeply in the muscular substance only streptococci were found, the saprophytes left behind. The streptococcus invasion proceeds in the course of the axis of the thrombus, and with the advance of the germs granular degeneration of the thrombus equally takes place. As the infection advances the walls of the veins may show germs and their pullulation. The veins of the broad ligaments are also the seat of infected thromboses.

Clinical Course of Lymphangitis, or Septicæmia. It seems probable, from the preceding researches, that the infection enters through the wound at the placental site, in the majority of cases following septic endometritis, but infection is also believed to occur, as previously stated, from tears of the cervix and of the vaginal entrance.[1]

The disease usually, not always, begins with a chill, and this beginning is seldom delayed beyond three days. High fever and increased frequency of the pulse are observed; the temperature may be from 103° to 105°, and the pulse 120 to 130. Morning remissions are observed; the temperature may then be only a degree or two above the normal. The patient is sleepless, restless, without desire for food, probably has nausea and vomiting, and complains of headache. The abdomen becomes tympanitic, possibly from intestinal paralysis resulting from absorption of ptomaines. The lochial discharge is often quite offensive, but the absence of such odor ought not to delude the practitioner into the false hope that peril is absent, or only slight, for a woman may quickly perish without such sign being present. In con-

[1] "Diffuse septic peritonitis, the malignant form of puerperal peritonitis, is developed chiefly from a severe septic endometritis; much more rarely is the entrance in the cervix or in the vagina." (Ahlfeld.)

sequence of the abdominal distention the respiration is shallow and the blood may fail to receive sufficient oxygen, and hence the face is slightly cyanosed. In rare cases pleuritis and pericarditis occur, this fresh invasion being generally marked by a chill.

The urine is usually scanty, and frequently is albuminous. The secretion of milk is lessened and disappears.

While, as a rule, the bowels are confined, exceptionally diarrhœa occurs, but without lessening the meteorism.

As a rule, distinct peritoneal symptoms are present, varying from slight to severe. In some cases the tenderness to the touch is great, while in others it is found only upon firm pressure on one or both sides of the womb, or upon this organ and in the umbilical region. In many cases peritoneal pain may fail, or be so slight that the danger of the disease is not recognized. The entire cessation of pain, with increasing exhaustion, is frequently a forerunner of swift death. The condition of the mind varies. Even at first there may be some mental dulness, though this is not characteristic; the intellect, on the other hand, may be perfectly clear until just before the end, and then one patient may be hopeful of recovery, and speak of the future of her life, while another realizes her peril, begging the doctor—how pitiful the prayer—to save her.

A fatal end may occur within the first three days, but more frequently this happens in the second week.

Prognosis. The sooner the disease follows labor the more probable a fatal result. Excessive vomiting, a notable quantity of albumin in the urine, and especially the condition of the pulse as to frequency and force, darken the prognosis; so, too, the complications that may occur which have been mentioned are unfavorable.

Treatment. In case endometritis has preceded the attack, local treatment is indicated when the lochial discharge has an offensive odor; this will be first limited to antiseptic vaginal injections—only in rare cases will benefit result from washing out or curetting the womb, and then most probably solely at the beginning of the peritoneal invasion. Pain in the uterus or adjacent parts will be best met by the application of the ice-bag. If this does not suffice, then opium may be employed. Reduction of temperature can be better effected by sponging with cool water, if agreeable to the patient, than by the administration of antipyretics, for these will derange the stomach and interfere with the patient taking food, a matter of the greatest importance in a disease attended with such prostration. The local application of guaiacol will often promptly lower the temperature, and is preferable, should such reduction be thought advisable, to the administration of large doses of quinine, antipyrin, and similar agents. Alcohol is to be given freely, in the form of wine, brandy, or whiskey; it strengthens a weak heart and it lessens the amount of albumin passing off by the kidneys. To secure sleep, sulphonal is advised by Runge, who states that chloral is at all events to be avoided. The abdominal distention may be temporarily lessened by using a rectal tube, passed high up, permitting the escape of gas through it, or by the injection into the rectum of oil of turpentine in suitable mixture. The constipation is relieved by a laxative injec-

tion; especially must active purgation be avoided. The vomiting is treated by ice-cold drinks containing carbonic acid. Kaltenbach has suggested washing out of the stomach as rational treatment, on the ground that partly through this organ a ptomaine or toxalbumin is probably eliminated.

The treatment of septicæmia by opium is now regarded with little favor. Nevertheless, it counted able advocates and undoubted successes. In 1848 the late Dr. Alonzo Clark first applied the opium treatment, which he had employed from 1841 to peritonitis from intestinal perforation, to puerperal peritonitis with success. The following is an extract from a letter written me in 1876 by Dr. Clark:[1]

"Regarding the rules, I begin with two grains of opium, or its equivalent opiate, and in two hours give the same, or more or less, according to the effects produced. Patients resist or yield to the narcotic effects of the drug very differently. In some cases twenty-four grains of opium a day are all that is required; in a few, twelve or sixteen grains are sufficient. In most, two to four grains at a dose are needed; in a few, more than this. The aim is to get and maintain the symptoms of safe narcotism, or, as I sometimes term it, semi-narcotism, indicated by subsidence of the pain, contracted pupils, itching of nose and skin, a continuous sleep, from which, however, the patient is easily aroused, reduced frequency of respiration, followed by reduced frequency of the pulse, and absolute quiet of the bowels. Regarding the respiration, the aim is to reduce its frequency to twelve in the minute, and in the attempt to do this it is often found to fall as low as seven without danger; if this occurs, the opium is then withheld for a few hours, till it rises to ten, when a smaller dose is given, to be increased or not afterward."

Most practitioners do not use opium, even in the treatment of puerperal peritonitis, so freely, but administer it chiefly for the relief of pain; frequently a hypodermatic of morphine may be usefully given for this purpose.

That great teacher, one of the greatest of his day, the late Dr. Charles D. Meigs, declared, speaking of the treatment of a woman having puerperal fever: "If I cannot cure her by venesection, my patient may recover by the providence of God. All other human means seem to me to be useless and beneath contempt, as prime remedies, venesection being omitted." But the practitioner of to-day, instead of taking, would try to make blood.[2]

Pyæmia. This form of puerperal fever occurs later than that previously presented—usually at the end of the first or beginning of the second week. The abdomen is flat, no tympanites; the chill is not single, but multiple, repeated during the progress of the disease, so that there are thirty or forty, or even a larger number of chills. In a patient attended by me in consultation there were more than fifty chills, and Ahlfeld states that in one of his cases there were fifty-seven. The temperature at one time may be 104°, and again become between the chills but a little more than normal, or even quite normal.

The great increase of temperature, followed by a decline with more or less perspiration, and the recurrence of chills with new accessions of fever, led Osiander thus to speak of the distinction between this form of puerperal septicæmia and intermittent fever:

[1] Author's Address on Obstetrics, International Medical Congress, at Philadelphia, 1876.

[2] In one of Smollett's stories a character for whom the doctor has prescribed "neutral draughts," asserts that "they are so neutral they declare neither for the patient nor for the disease." This criticism would not apply to the treatment of puerperal fever by bleeding; for, with the views of the pathology of the disease now prevailing, such treatment would be regarded as declaring for the disease, not for the patient.

"This fever differs from the common cold or intermittent fever which attacks women in childbirth sometimes, or with which they oftentimes pass from pregnancy into childbed—and which, according to the testimony of writers, Torti, for example, is always very dangerous, but which can generally be cured by the use of the Peruvian bark—in this respect: at the time between the attacks a real abatement of the feverish pulse cannot be perceived, and the chill never occurs at a definite or regular time."

Metastases to various organs or parts of the body may occur—the liver, spleen, kidneys, thyroid, lungs, mammary gland; to the eye, causing panophthalmitis; to the connective tissue, to joints, etc. A singular fact, and, I believe, as yet without satisfactory explanation, is, that if a joint of one of the lower limbs is affected it is the right knee oftener than any other. After metastases occur the fever is usually continuous.

The frequent chills, the absence of abdominal swelling, the repeated and great variations in temperature, and the absence of all indications of peritoneal inflammation, and, finally, the occurrence of metastases, would prevent confounding pyæmic with septicæmic infection.

While the prognosis is serious, it is not so grave as in septicæmia. The treatment is symptomatic. Chills are met by hot drinks, usually containing whiskey, brandy, or wine. Antipyretics are of no value in high temperatures; the reduction of the heat will soon spontaneously occur, and the medicines employed may produce disorder of the stomach, lessening even the ability to take food. One of the best authorities has recently stated, that upon good nutrition, careful nursing—especially protecting parts subjected to continued pressure from bedsores, preventing active movements lest emboli may thus be detached from thrombosed veins—and alcoholic stimulants as occasion may require, the hope of recovery will rest rather than on the administration of drugs. Kaltenbach has advised, in great, continued frequency of the pulse, tincture of aconite or infusion of digitalis, and in severe heart weakness preparations of coffee by the mouth and hypodermatic injections of ether, tincture of musk, and oil of camphor.[1] If a joint is affected, at first let it be made immobile; suppuration occurring, evacuation of the pus; after the fever is gone, and all acute symptoms of the affection have disappeared, massage and passive movements of the joint must be employed to reduce the swelling and to prevent the temporary anchylosis from becoming permanent. At this stage, too, relief from pain and swelling will be obtained by successive small blisters of cantharidal collodion.

The patient must remain in bed for two weeks after the fever has disappeared.

Surgical Treatment. The removal of tubes containing pus has several times been successfully done in puerperal women. Nevertheless, knowing that pyosalpinx is not a frequent manifestation of puerperal infection, and bearing in mind the researches of Bumm, previously referred to, showing the barrier presented by the uterine ends of the tubes

[1] Leyden (Deutsch. med. Wochenschrift, January, 1894) states that in severe cases of puerperal sepsis cardiac manifestations are not rare, chiefly weakness, finally paralysis. This is explained as due to the action of a toxic substance upon the heart, this substance produced from the rapid development of septic bacteria, chiefly streptococci, more rarely staphylococci. The autopsy of a case of fatal infection showed a very pale heart, no fatty degeneration of the muscle, but dilatation of the left ventricle.

to the progress of the infection in septic endometritis, so that the poison traverses the uterine wall, and only gets access to the tubes by their abdominal openings, it may be questioned whether in many of these cases the infection was puerperal, and the purulent collections possibly antedated the pregnancy. Be this as it may, encysted collections of pus, whether tubal or not, found in connection with puerperal infection, should be removed. Further, success may reasonably be expected in case of purulent peritonitis, from abdominal section, removal of the pus, washing out and disinfecting the abdominal cavity. But in general septic peritonitis the hope is vain from this treatment. Removal of the uterus in pyæmic infection has little to promise, and probably were all the cases in which this operation has been done reported, the number of successes would be small. Unfortunately, too, in many instances reported of hysterectomy for the removal of an infecting centre, there fail the perfect clinical history and the careful microscopic examination demonstrating the essential nature of the disorder.

Dr. Parish[1] has published a most instructive case of successful abdominal section for uterine lymphangitis, the infection being plainly septicæmic, not pyæmic.

He was called to the patient the third week of her lying-in, and the following is the description of his operation: "I opened the abdomen in the median line, under aseptic precautions. After dissecting up adhesions I found the appendages of both sides free from pus. The uterus presented a bilobed appearance, with a nearly median vertical groove. The right lobe was doughy to the touch, without fluctuation, and of a dark-purplish color. Around it the exudate and adhesions had been arranged. On puncturing this part of the uterus about two ounces of pus escaped. The abscess cavity presented irregular, ragged walls, and did not communicate with the uterine cavity. I now secured the uterine and ovarian arteries of one side by tying off the broad ligament at its base and at its pelvic extremity. Thus, by two semi-elliptical incisions in the uterus, longitudinal in direction, and extending from near the neck to the fundus, one behind, the other in front of the uterine end of the broad ligament, I removed a wedge-shaped portion of the uterus, including within the wedge the connection of the broad ligament and the walls of the uterine abscess. These incisions did not reach the uterine cavity. Numerous lymphatics about the abscess showed on section pus within their calibres, as I have repeatedly seen in autopsies on women dead of lymphatic septicæmia. Several thin sections were now removed from the incised portions of the uterus until more nearly healthy uterine tissue was reached; I then drew together the lips of the uterine wound with silk sutures."

It is not necessary to continue the further narrative given by Dr. Parish, and there will only be added that the patient made a satisfactory recovery. As a pioneer operation and wise, it is worthy of this additional record, and of just commendation. Future experience must decide whether the field of surgery in puerperal infection ought to be enlarged or lessened.

Ulcerative Endocarditis. This is the most serious manifestation of puerperal poisoning, and occurs more frequently in pyæmia than in septicæmia, while in some cases the two modes of infection may be present—that is, a septicopyæmia. It is almost always restricted to the left heart, and depends upon micrococci; the streptococcus, staphylo-

[1] Transactions of the American Gynecological Society, 1892.

coccus, and the diplococcus of pneumonia have been demonstrated. The disease usually not appearing before the second week, begins with a chill, followed by severe fever, the temperature 104° or higher, the pulse from 130 to 160, small, easily compressed, and, according to Olshausen, frequently dicrotic. Chills continue. Retinal hemorrhage is found in 80 per cent., and cerebral disorder may occur; the patient complains of violent headache, is restless, and cannot sleep, possibly becomes delirious. Meningitis is not uncommon.

The diagnosis of ulcerative endocarditis is made by the frequency of the pulse, and its weakness, by a loud systolic murmur heard over the aorta and over the mitral, by the frequent chills, and by the condition of the eyes.

The patient usually lives more than a week, but death is inevitable, and hence the treatment, which will be symptomatic, can only palliate.

PROPHYLAXIS. Concluding this chapter upon the chief forms of puerperal infection and their treatment, and having seen that in some of these therapeutics may completely fail, let the importance of prevention be more deeply impressed on the obstetrician's mind. A few years ago a distinguished British[1] obstetrician suggested that "through an extended study of microbiology and of organic chemistry we may hope to become possessed of means which will destroy pathogenic microbes in the body without damaging the patient, and thus cure puerperal fever." But even if that day should come, the duty of preventing puerperal fever by strictest asepsis and judicious antisepsis must always remain, and still more imperative is the duty before its coming.

[1] James Watt Black, M.D.: Inaugural Address as President of the London Obstetrical Society, 1891.

CHAPTER XVII.

SUDDEN DEATH IN, OR AFTER LABOR—DISEASES OF THE NEWBORN.

Sudden Death in, or After Labor. Whether one believe, with the Roman Emperor, that the death which is most sudden is that most to be desired, or place it, as is done in the rubric familiar to all, at the climax of earthly calamities, this event is always startling and usually most painful to the witnesses. The pain is greatest, the misfortune almost without exception the gravest, if a mother dies in childbirth or soon after. Many causes conspire to make the event peculiarly sad. The abrupt severing of new ties, the loss of life in giving life, and the sharp contrast between an infant living and a mother perishing just when the former so needs her loving care, are among these causes.

The obstetrician not infrequently suffers public reproach when such an event occurs in his practice, for people are slow to understand how that which is in the majority of cases a simple physiological process may have a fatal issue. Moreover, in some instances death can be averted if the practitioner, forewarned of its imminence, uses appropriate means; in others the prophecy of such event as possible, probable, or inevitable may protect his reputation; and in still other cases, if prophecy should fail—the event, casting no shadow before it, coming unexpectedly to him as to others—his ability to explain its cause is very important. It is therefore alike his duty and interest to know the usual causes of sudden death in childbirth or after it.

Constant supply of oxygen to the organism and the regular distribution of blood suitable for nutrition are the two essentials[1] for the maintenance of life; in other words, the lungs and the heart must perform their respective functions, and thus the tripod of Bichat is replaced by a biped, for the brainless fowl lives, though it instantly perishes if deprived of heart or lungs. In most cases of sudden death the heart, the *ultimum moriens* of Galen, first stops, or, in other words, death is caused by syncope, not by asphyxia. If death begins at the lungs, the fatal event is usually slow in progress; nevertheless, it may then in some instances be sudden, as from pulmonary embolism, just as, on the other hand, cardiac death does not always occur even rapidly. In still other cases lungs and heart may both fail, the failure of neither being the exclusive cause of death.

Death from Syncope. The fact that syncope may be caused by a strong mental impression, as fear, anger, joy, or sorrow, is familiar to the profession as well as to the public. A reasonable supposition is that

[1] Strauss: Nouveau Dictionnaire de Médecine et de Chirurgie pratiques, t. xxxiv.

in such cases the impression upon the brain is first reflected to the bulb, then probably through the pneumogastric nerves the bulb itself arrests the action of the heart, and hence the sudden paleness, the cerebral anæmia, and the syncope.[1] Wundt, adopting Kant's classification of emotions into sthenic and asthenic,[2] says that the former kill by apoplexy, and the latter by cardiac paralysis, or rather by the interruption of cardiac function which energetic and persistent excitement of the inhibitory nerves of the heart causes.

The greater nervous susceptibility of woman than of man, and its notable increase during pregnancy, would explain the special liability she then has to be injuriously affected by a profound emotion, whether of pain or of pleasure.

Chevallier has narrated cases of sudden death occurring to puerperæ which he attributed to idiopathic asphyxia. But, as remarked by McClintock,[3] "some very competent authorities look upon the mortal affection described by M. Chevallier as merely a form of syncope." Undoubtedly the later term is the correct one. It is remarkable that several of the cases adduced were those in which death followed a strong emotion; in other words, they were instances of fatal emotive syncope. One of these, for example, taken from Morgagni, was that of a multipara, who, after an easy labor, was delivered of a girl, her husband and she both being desirous of a boy; the sex of the child was imprudently told her; she was affected with such deep sorrow that her pulse became weak and her skin cold, and in a few hours she died; the autopsy presented no satisfactory cause of the fatal result.

Winckel[4] refers to strong mental emotion, especially severe suffering, as a cause of sudden death, and states that Baart de la Faille has collected 13 cases of post-partum collapse in which neither embolism nor the entrance of air was probable, but in which, however, the entire complexus of symptoms had very great similarity to cardiac paralysis.

Dr. Lusk[5] lost a primipara two hours after delivery with forceps, and he attributed the death to "nerve-exhaustion and shock." Dr. Fayette Dunlap,[6] in the case of a patient dying a few hours after the termination of her labor, regarded exhaustion as the cause of the unhappy event.

1. *Death may be Caused by Pulmonary Embolism.* A thrombosis having formed in uterine, pelvic, or femoral vein, an embolus is detached, and passing to the right heart is arrested in the pulmonary artery. The most frequent instances of this accident have been observed in patients suffering with phlegmasia alba dolens.

The unhappy victim may take the erect or sitting position after having been recumbent for days or weeks, or make other slight exertion, and death come suddenly as if from a thunderbolt.

The death may be caused by embolism just after labor as a consequence of artificial thrombosis in a uterine vessel. Herman and Brown have reported the following case: An intra-uterine injection of a solution of perchloride of iron was used for post-partum hemorrhage, and

[1] Strauss, op. cit.
[2] Elements of Physiological Psychology.
[3] Dublin Medical Press, 1852.
[4] Lehrbuch der Geburtshülfe.
[5] Journal of the American Medical Association, 1884.
[6] Ibid., 1887.

the woman died, the death being attributed to an embolus from a thrombus in the uterine vein.[1]

2. *Death may be Caused by the Entrance of Air into the Uterine Veins.* A patient of Olshausen[2] was having used while she was in labor a uterine douche to hasten effacement of the cervix; she complained of pain, raised herself up in bed, gave some deep inspirations, and died in a minute. At the autopsy, made eight hours after death, bubbles of air were found in the cardiac vessels, in the uterine veins, and in the inferior vena cava. In Litzmann's case four uterine douches were given with Mayer's pump to induce premature labor; suddenly the woman became livid and died in a few seconds. The post-mortem, made sixteen hours after death, showed bubbles of air in the uterine veins and in the ovarian and renal plexuses.

Gunz has reported the case of a girl twenty years of age who was found dead in her room, having between her limbs an irrigator, the canula being in the vagina. She was found to be three months and a half pregnant, and death was shown to have resulted from the entrance of air into the veins, the canula having penetrated the cervical canal. Spontaneous entrance of air is illustrated by the following case: A secundipara, twenty-five years of age, was, after an easy labor, delivered of her child while lying upon her side; she was then turned upon her back, gentle massage used, and the placenta was expelled. The face suddenly became livid, the respiration labored, the pulse weak; after vomiting a little mucus and after slight convulsive movements she became collapsed and died. At the autopsy the uterus was found as large as the head of a child, and its walls relaxed. In compressing the posterior wall and the fundus of the uterus at the place where the placenta had been attached fine crepitation was heard; when the organ was thrown into water a great number of small bubbles of air escaped. The parts of the uterus near the cervix did not appear to contain air, nor did the veins of the broad ligament, the ovarian veins, or the vena cava.

Another instance is the following: Cordwent has given[3] the history of a primipara, twenty-eight years old, who was delivered while standing, of a living male child, which fell to the floor, dragging the placenta and membranes with it. A "gurgling" was heard by the attendants, and the woman died almost immediately. At the post-mortem air was found in the uterine wall at the fundus, in the coronary vein, and in the right heart.

Winckel,[4] in referring to the entrance of air into the uterine veins as a cause of sudden death, remarks that in an examination during labor, in the removal of the placenta from the vagina, in the introduction of the hand into the uterus for the purpose of removing the placenta, the entrance of air is almost inevitable, and that sometimes the contained air escapes with a quite audible sound. He also refers to the fact that if the os uteri be closed and decomposition of retained material occur in the cavity, gas may enter the circulation.

Frendenburg states that in six years at the Berlin Klinik there were three deaths from air entering veins in placenta prævia; instances of fatal air-embolism during the application of an iodoform-gauze tampon for hemorrhage have been observed.

Lauffs[5] has collected 43 cases of air entering the uterine veins. In 17 the accident was caused by injections into the birth-canal, 18 were spontaneous, and 8 resulted from the formation of gas in the uterus; 39 of the 43 were fatal, and the presence of air was proved by the autopsy in 31.

[1] Obstetrical Journal of Great Britain and Ireland, January, 1880.
[2] For these cases see Braun on "Sudden Death from the Entrance of Air into the Uterine Veins," Wien. med. Woch., 1883.
[3] St. George's Hospital Reports, London, 1873.
[4] Op. cit.
[5] Ueber Eintritt von Luft in die Venen der Gebärmutter bei und nach der Geburt., Bonn, 1885.

The presence of air in the veins in an autopsy does not prove death from air-embolism, for Welch and Nuttall have shown[1] that this may originate from a gas-producing bacillus, *bacillus aërogenes capsulatus*, as named by them. Graham[2] also described a case in which this bacillus was proved to be present; and Ernst[3] has made a thorough study of the subject. Nevertheless, the suddenness of the death from air-embolism would be sufficiently characteristic.

3. *Death may Result from Some One of the Accidents of Labor.* These accidents have already been considered, and it is hardly necessary to remind the reader that hemorrhage, rupture or inversion of the uterus, or eclampsia, may cause sudden death.

4. *Different Diseases may Cause Sudden Death.* Among these may be mentioned rupture of an aneurism or of the heart, having undergone fatty degeneration, cerebral or pulmonary apoplexy, pulmonary emphysema, hæmoptysis, rupture of the spleen, rupture of an hepatic abscess, and hæmatemesis.

Diseases of the Newborn. *Sclerema Neonatorum.* The following is the definition given by Ballantyne[4] of this affection: A grave disease, occurring almost always in the newborn infant, characterized by induration and sometimes by œdema of the subcutaneous cellular tissue, and by lowering of the body-temperature, and due possibly to some trophic lesion of the nervous system. Ahlfeld regards the cause as probably being in an interference with the circulation from deficient activity of the muscular respiratory apparatus and pulmonary atelectasis. The disease is usually fatal, death generally preceded by a discharge of bloody serum from the mouth and nose.

Hot baths, hot wraps, massage from the periphery to the centre, exciting strong crying, in order to promote the circulation, and Auvard's *couveuse*, have been recommended in the treatment of sclerema.

Diseases of the Umbilicus. Suppuration may occur after the umbilical cord has fallen off. Kaltenbach recommended washing with 3 per cent. solution of boric acid, or dusting with salicylic acid and starch, 1 : 3. I have in some cases employed washing with alum-water and then pencilling with the compound tincture of benzoin.

Abundant granulations may spring from the surface to which the cord was attached—the so-called *umbilical fungus*—and give rise to abundant secretion, and sometimes bleeding occurs. Burnt alum I have generally found sufficient to destroy the growth; some advise nitrate of silver, or even nitric acid.

Erysipelas, beginning at the navel, and thence extending over part of the body, is sometimes seen in the newborn. The only instances in which I have observed this were in children whose mothers were suffering from septic infection, and the disease was, without exception, fatal, convulsions generally occurring. Facial erysipelas may occur in the newborn, but it is less grave than the variety mentioned.

Instead of this manifestation of disease derived from the sick mother, there may occur, from the entrance of streptococci through the navel

[1] Bulletin Johns Hopkins Hospital, July-August, 1892.
[2] Columbus Medical Journal, August, 1893.
[3] Virchow's Archiv, 1893.
[4] Diseases of the Fœtus, vol. ii.

wound, either lymphatic or pyæmic infection; in the one case peritonitis and pleuritis, and in the other abscesses in the liver and thromboses result.

The fatal result of this infection emphasizes the importance of antiseptic treatment of the cord, and of the immediate removal of the child to another room if the mother should manifest serious infection; the child should then, too, have another nurse than the one who cares for the mother.

After the disease has occurred treatment, as Winckel says, only palliates, does not cure.

Tetanus sometimes occurs in the newborn, the poison of Nicolaier's bacillus—tetanin—entering most probably through the umbilical wound. Since the discovery of this bacillus and the establishment of the etiology of the disease some doubt may be expressed as to its originating from hot baths.

Ahlfeld repeats the fact, published several years ago, that a midwife, out of 380 infants delivered by her in the years 1864 and 1865, had 99 attacked by tetanus; the cause of the disease was supposed to be the very hot baths she employed in washing the newborn.

The disease has been observed more frequently in hot climates; but here, as in puerperal tetanus, the fact is explained by the want of cleanliness rather than the character of the climate.

Turner,[1] in a recent paper entitled "The Scourge of St. Kilda," refers to the great mortality from tetanus neonatorum in that island, quoting in illustration the statement made by Dr. Arthur Mitchell in the *Edinburgh Medical Journal*, 1865: "Out of 125 children, the offspring of the fourteen married couples residing upon the island in 1860, no less than 84 died within the first fourteen days of life—or, in other words, 67.2 per cent."

In recent years this mortality has disappeared in consequence of antiseptic dressing of the cord.[2] Turner alludes in his paper to *loretin*, a new preparation of iodine, odorless and not poisonous, as a very efficient germicide, 1 to 1000 destroying pathogenic bacteria. It must be remembered, however, that the bacillus of tetanus has remarkable vitality.

The disease is first manifested about the time the cord is detached, or within a few days after. Probably the physician's attention will first be called to the fact that the infant does not nurse, and upon examination he finds trismus, though before this symptom there may be observed restlessness, and trembling of the lower jaw. Opisthotonos follows, the temperature rises—109.4°, according to Winckel—and the child soon perishes, usually from exhaustion.

Chloral may be given, chloroform inhalation used, and endeavor made to maintain the nutrition[3] by suitable rectal injections. But these means only, as a rule, delay death, do not cure the disease. There may be hope, as in puerperal tetanus, from hypodermatic injection of serum from an animal rendered immune to tetanus.

[1] Glasgow Medical Journal, March, 1895.

[2] Dr. A. C. Kellogg, of Portage, Wisconsin, has recently invented a very useful instrument for applying a rubber ring, instead of the ordinary ligation of the cord, furnishing a perfect safeguard against hemorrhage, and, at the same time, the rubber being made aseptic, may facilitate the antiseptic treatment of the cord.

[3] Papiewski (Jahresbericht über die Fortschritte auf dem Gebiete der Geburtshilfe und Gynäkologie, 1894) gives 12 cases of the disease observed in the Kinderklinik at Gratz, 10 dying and 2 recovering; and he states that the disease with a short incubation stage, one to five days, is absolutely fatal.

Nearly two years ago, in consultation with Dr. W. M. Angney, of this city, I saw a case of tetanus in an infant eight days old. Attention was directed to the disease by the fact that the child could not nurse, and the cause was found in well-marked trismus. Under the use of different remedies, chiefly chloral, and nourishment given by the rectum, there was a temporary improvement, but death occurred on the eleventh day. The nurse was far from being cleanly in her habits, and probably the infection occurred from her improper care of the umbilical stump.

Umbilical hernia may sometimes be successfully treated by strapping; the best method of strapping is, not by adhesive or isinglass plaster, but taking two narrow strips of mull, fastening one end of each by collodion, and then reducing the protrusion, passing them over it in the form of a Greek cross; next the free ends are similarly fastened by collodion; this permits the application of antiseptic solutions, if required, through the middle portion of the strips.

Gonorrhœa may cause inflammation of the eyes of the newborn, and also, though very rarely, vulvitis and vaginitis, and still more rarely it causes, according to Dohrn and Rosinski, inflammation of the mouth.

The first affection even is not frequent. Its prophylaxis, so far as a vaginal injection of corrosive sublimate for the mother, has been stated on page 290, and so far as it relates to the infant, Credé's method—the use of nitrate of silver—is found on page 290. Kaltenbach stated that by the employment of the former, that is, the vaginal injection of corrosive sublimate, and washing the eyes of the infant with water free from germs, he had, both in Giessen and Halle, absolutely good results. It is very important that in washing the eyes of the newborn the water employed in washing the body should never be used.

That the conjunctival inflammation is probably gonorrhœal may be assumed from the fact that the mother at the time of labor was suffering from a purulent discharge, that the inflammation appeared from the third to the fourth day (according to Kaltenbach, the lids are red and swelled even the second day), and that it is quite severe; the positive proof could only be had by examination of the secretion with the microscope, and therein finding the gonococcus.

The treatment will be thoroughly washing away the purulent secretion with warm water, the application of a solution of nitrate of silver, one to two grains to the ounce, and then a light compress which has been dipped in a 3 per cent. solution of boric acid is applied, and over this ice. Ahlfeld speaks of the ice-treatment as absolutely certain, but it must be continued day and night; from hour to hour the lids are separated and cleansed by cotton and distilled water. Beside, if the mucous membrane of the lids is greatly swelled, separation of these causes its eversion, and it is to be pencilled with a ten-grain solution of nitrate of silver, and the excess of the salt washed away with a 1 per cent. solution of chloride of sodium.

More frequently the practitioner will meet with simple, rather than specific conjunctivitis, and its mild form can usually be successfully treated with zinc acetate or sulphate, two grains to the ounce of rose-water, applied once or twice a day; but he should remember that any such application must be thorough, so that the solution may be diffused over the entire surface diseased.

Gonorrhœal vulvitis and vaginitis is explained by Ahlfeld as resulting from the mother, the wet-nurse, or the nurse in washing the infant bringing gonorrhœal matter in contact with the parts. The treatment is by corrosive sublimate, 1 part to 5000.

Acute hæmoglobinuria, known also as Winckel's disease, because he first proved its character, is rare. The disease is manifested by cyanosis, jaundice, and hemorrhages from various organs. A fatal result usually occurred in thirty-two hours; nineteen out of twenty-three cases seen by him died.

Melæna neonatorum designates a disease of the newborn characterized by discharge of blood from the stomach and from the bowels; in some cases only the latter occurs. Of course, those cases in which the mother's nipple bleeds in nursing, the blood being swallowed by the child, are excluded. Hergott[1] states that the disease occurs once in 1000 to 1500 births. One-half the patients affected with melæna die, Kaltenbach has said; but Winckel gives eleven cases with only four recoveries. Hæmophilia has been found in some, duodenal ulcer in others; embolism of gastric and duodenal vessels, arising from thrombosis of the umbilical vein, is the explanation given by Landau, and some attribute the disease to infection, the nature of which and the medium of entrance being unknown.

The treatment generally recommended is muriated tincture of iron, and Winckel suggests a firm bandage to the abdomen.

Acute fatty degeneration of the newborn, or Buhl's disease, described by Buhl in 1864, consists in a fatty degeneration of the cardiac muscle, of the kidneys, and of the intestinal epithelium. Small hemorrhages occur in various organs, heart, pleura, peritoneum, skin, meninges, etc. Kaltenbach refers to the children generally being born asphyxiated, and in the first days appearing cyanosed, and later become jaundiced; the infant has diarrhœa, often also vomiting, and next bleeding from stomach and intestine, later from the navel. Both this and Winckel's disease have been attributed to infection—"perhaps a severe sepsis," Ahlfeld suggest as the cause of this malady.

[1] Arch. de Tocol. et Gyn., April, 1894.

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A MANUAL FOR STUDENTS AND PRACTITIONERS.

BY GERMAN SIMS WOODHEAD, M.D., F.R.C.P.ED.,

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PUBLISHER'S NOTE.

The recent advances in Pathology have rendered it necessary that in the third edition of this work the scope should be somewhat enlarged and altered in several important respects.

The Chapter on Methods has been brought well up to date; a Chapter on Inflammation and Healing of Wounds has been added, and much new matter, especially as regards the naked eye appearances of diseased tissues and organs, has been incorporated with the other sections; greater attention has been paid to the arrangement of descriptions and details; repetition has been avoided as much as possible; and the references to methods of hardening, preparing, and staining, have been so arranged as to interfere as little as possible with the continuity of the descriptions. The whole work has been revised; much of it has been re-written and so recast as to make it available for both practical class-room work and home study. Many of the old plates have been re-drawn, and the number of illustrations has been increased from 162 to 195.

EXTRACTS FROM PRESS NOTICES.

"There is no better index of the progress of science than that which is afforded by the successive editions of a Standard Text-book. The author of such a work, if he wishes his book to maintain its popularity, is compelled to keep pace with advancing knowledge, and must perforce enlarge the limits of his manual. To do this well requires much skill and judgment, as well as an intimate acquaintance with the growing literature of his subject, and practical familiarity with modern methods. Those who remember the advent of Dr. Woodhead's manual nine years ago, and the freshness with which the details of morbid histology were described and illustrated, will find in the latest edition a considerable amplification and revision of the text, as well as many new coloured engravings, which form a notable feature of the book. Thus the work has much increased in bulk, without losing any of its characteristic points. In a word, the book cannot fail to be of the greatest service to the worker in the pathological laboratory, and Dr. Woodhead may be congratulated upon the success with which he has managed to render it one of the most useful and practical manuals of its kind."—*Lancet.*

"The merits of Dr. Woodhead's *Practical Pathology* are already so well known to the profession that but few words are required on our part to commend it anew to their attention. The present edition retains all the good features of its predecessors, with a number of additional good qualities of its own. Great care has obviously been taken throughout in its preparation. It has been almost entirely re-written, much of it altered and re-arranged, and a great deal added. It forms now a volume of 652 pages, as compared with the 484 pages of the first edition. A notable feature of this work from the very first has been the great beauty of its coloured illustrations. In this respect, also, the merits of the book have suffered no abatement in the present edition. A large number of new illustrations have been added; and in every case where new ones have replaced those in the earlier editions, the change is an improvement. Both author and publisher are to be specially congratulated on this portion of their work. We can confidently recommend this work as one of the best practical treatises dealing with the subject of morbid histology that have appeared in this or any other country."—*British Medical Journal.*

"Woodhead's *Practical Pathology* has become one of the standard text-books for students of human pathology; indeed it may be said to have occupied that position ever since its first appearance nine years ago. For some time past the work has been out of print, and that fact must have caused considerable inconvenience to medical students, inasmuch as there is not in the market any book at all approaching it in usefulness as a guide to practical pathology. The scope of the work has been enlarged, the matter has been partially re-arranged, and the illustrations have been improved and increased in number. Taking text and illustrations together, the book is a model work of its class, and medical students of the present day are to be congratulated on having at their disposal such an admirable aid to the practical study of pathology. We strongly recommend it to both veterinary practitioners and students as the best book on the subject that is obtainable in the English language."—*Journal of Comparative Pathology and Therapeutics.*

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